The 6th International Conference on Welding, Non Destructive Testing and Materials Industry

WELDING
METALLIC MATERIALS
CORROSION AND MATERIALS PROTECTION
NON-DESTRUCTIVE EVALUATION OF MATERIAL

CRTI

IC-WNDT-MI'18

07th - 08th NOVEMBER 2018
SKIKDA, ALGERIA

BOOK OF ABSTRACTS

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Table of contents

The 6th International Conference on Welding, Non Destructive Testing and Materials Industry (IC-WNDT-MI'18)

Topic 1

Welding, welding metallurgy, simulation of process, residual stresses in welding, electric Arc, plasma

XC38 nitriding by plasma immersion ion implantation

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Centre de Développement des Technologies Avancées (CDTA), Cité 20Août 1956 B.P.17 Baba Hassan, Alger, Algérie.

Abstract. In this work, nitrogen plasma immersion ion implantation (PIII) treatment of carbon steel was performed in a plasma reactor with an inductive RF source (l3.56 MHz) at low pressure in order to investigate the influence of the process conditions on the corrosion properties. The aim of this work is to improve the micro-hardness and corrosion resistance of the XC38 steel for industrial applications. The result shows that the micro-hardness of the samples was highly increased up 100% compared to the untreated state. In addition, it was shown that the implantation of nitrogen leads to protect to the surface and improves the corrosion resistance of XC38 steel.
Keywords : Plasma nitriding (PIII), XC38, micro-hardness, Corrosion resistance, Negative DC bias voltage.

Numerical Investigations on Metal Laser Additive Manufacturing

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Abstract. The industry 4.0 is expected to deeply move the concept of the production by using machines that can manufacture the desired parts fastly and more efficiently than ever before. The research-development in the field is at its beginning, where the numerical models are helpful for predicting the useful parameters in order to obtain an optimized product. In our contribution, we present some results of the developed simulations on Laser Metal Deposition (LMD) process using the finite volume method and interface tracking approaches. The results allow to obtaining the pattern of the deposited material, and a knowledge of the temperature field distribution. The last can be used to reach some structural aspects which are determinant for the product quality.
Keywords : additive manufacturing; laser; powder; 3D objects.

Aging of Butt Welded Polyethylene Pipes Used in Algerian Gas distribution Systems

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Abstract. The objective of the present paper is to conduct an investigation of aged butt welded polyethylene pipes which have been in use for 16, 20, 24 and 29 years in Algerian gas distribution systems. A special focus has been put on mechanical characterization.Studies were performed using tensile and hydrostatic pressure testing.For all welded pipes,the characteristics were compared to the nonwelded counterparts. An attention was paid to material stabilization which is essential for long term applications. Therefore,the oxidation induction time was measured at the weld zone and the pipe wall in order to assess the efficiency of the remaining amount of antioxidants. The results revealed that tensile properties and hydrostatic pressure strength of welded pipes were not affected by ageing as the nonwelded counterparts. Furthermore, oxidation induction time results showed that welds are more sensitive to thermooxidative degradation than pipes. However, the remaining amount of antioxidants after ageing ensures a sufficient stability of materials for a continuation of the service.
Keywords : Polyethylene pipes; butt welding; ageing; mechanical properties; gas distribution.

Modeling and 2D Simulation of a Planar Inductance with Maxwell (15.0)

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Abstract.This work presents the modeling and simulation of a planar inductance integrated in a magnetic circuit for a switching frequency ranging from 1 to 10MHz. The maximum current ripple across the inductor is 5 A. This work also describes the inductance sizing and the choice of magnetic materials used. Ferrite was chosen for its small thickness, low losses and high relative permeability up to 10MHz. We simulated our coil model before and after pressing the magnetic core using Maxwell software (15.0) in 2D.
Keywords—Integration; planar inductance;2D Modeling.

Trajectory tracking and obstacle avoidance by a fuzzy logic controller

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Abstract. In previous works, it has been demonstrated that the nonlinear model predictive controller provides a fast solution and can be used in real time applications. In this work**,** a fuzzy logic controller is used to control a mobile robot for trajectory tracking and obstacle avoidance. Simulation and experimental results are presented for the studied controller with performance analysis in terms of the computation times and quality of tracking and obstacles avoidance.Effectiveness of the studied controller is compared with NMPC controller.

Qualitative and Quantitative Assessment of γ and δ Phases in Duplex Stainless Steel Weldments by the X-Ray Diffraction Technique

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Abstract. This paper is focused on the quantitative and qualitative characterization of austenitic-ferritic stainless steel welds by the X-ray diffraction technique. The first weldment realized by gas tungsten arc welding process GTAW with ER2209 electrode, the second weldment by shielded metal arc welding process SMAW with E2209-15 electrode. The results show that the presence of two phases, austenite γ and ferrite δ without any precipitation of secondary phases either in the base metal BM or in the two welded zones. Moreover, there is an increase in the ferrite content and the existence of non-uniform compressive stress in the GTAW weld zone.
Keywords: welding; X-ray diffraction technique; duplex stainless steel; ferrite and austenite.

Improving the Power Quality of the Arc Welding Supply using an Active Power Filter

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Abstract. This paper presents a new circuit topology suitable for arc welding inverter applications, this topology is based on shunt active power filter (APF), in order to improve the power quality and reduced the total harmonic distortion (THD) by consequently improve the power factor (PF), a modified active and reactive power method (*p-q*),which is combined with a self-tuning filter, is used to identify the harmonics currents references of the load current, Also a PI controller has been used to maintain the level of DC-link voltage at a constant value and improves its dynamic response; the voltage source inverter of APF is controlled by hysteresis current controller. The Major favorable features of this topology like fast response to load and source voltage conditions will result in better welding performance. The performance of the entire system is evaluated on the basis of THD of the source current, input power factor, dynamic response, voltage regulation and robustness to prove its effectiveness in terms of excellent power quality.
Key words: arc welding, active power filter (APF), power factor (PF), total harmonic distortion (THD), modified active and reactive method (p-q).

Study of pulsed TIG welding of AZ31 magnesium alloy

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Abstract. The technological mastery of the TIG welding process is of great importance for the realization of quality welds. The application of TIG with pulsed current on magnesium alloy AZ31 is the object of this work. A testsare carried out, the effect of the frequency is studied, it shows a variation of the current Ip, Ib for low frequency and is equivalent for high frequencies for a constant initial current. Hot cracks are also shown and a metallurgical and mechanical characterization is presented.
Key words: Welding, TIG Pulsed, welding frequency, magnesium alloys.

Analysis and Simulation in Electrical Networks Using SSSC Device for Damping Power Oscillations

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Abstract. A large power system has many interconnections and bulk power transmissions over long distance. As a result, there low frequency inter-zone oscillations which make the system vulnerable to cascade failures. Many different methods have been proposed to alleviate the oscillations in the power system. For many years, Power System Stabilizer (PSS) has been one of the devices traditionally used to dampen oscillations. It is reported that during some operating conditions, PSS may not effectively attenuate oscillations; for this reason, other effective alternatives are required in addition to PSSs. On the other hand, the advent of FACTS has led to a new and more versatile approach to controlling the power system in a desired way. These devices based on very advanced power electronics components (GTO, IGBT,…). FACTS devices according to their network connection are distinguished countervailing series, shunt and hybrid such as: SSSC, ASVC and IPFC, respectively. One of the best-innovated Flexible AC Transmission System devices is the Static Synchronous Series Compensator. The purpose of this paper is to study the control functions provided by the SSSC in controlling the power flow of the load capacity of power lines.
Keywords: PSS; FACTS; GTO; IGBT; SSSC; ASVC; IPFC.

Evaluating the Flicker caused by Electric Arc Furnace through the Multi-scale Entropy MSE Algorithm SampEn

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Abstract. This paper presents a new method to evaluate the Arc voltage quality in electric arc furnace (EAF). It has been shown that is possible to allow the representation of nonlinear dynamics and coupling effects between different waves for irregularity of electrical signals issued by electrical components though multi-scale entropy algorithm SampEn. This work shows the behavior of the feature extraction with SampEn when it's used to evaluate the signals that deviate the arc voltage in (EAF). Flicker effect with voltage imbalances are analyzed by means of the SampEn concept.
Keywords: Entropy, Arc voltage signals quality, Flicker effect and voltage imbalance.

Improvement the surface hardness of XC38 steel by heat treatment - Approach by factorial plans

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Abstract. The surface hardness plays an important role in the service life of a mechanicals parts subjected to friction and wear. It can be improved by mechanical treatments or heat treatments. The latter occupy an important place in steel metallurgy, they aim to improve the performance of mechanicals properties of materials such as resilience and hardness and consequently they contribute in a visible way to the good resistance to fatigue and wear treated pieces.This work aims to predict the surface hardness Hv as a function of heat treatment parameters in this case the treatment temperature and holding time. therefore thermals treatments have been envisaged following the methodology of factorial plans 2_2 where two parameters have been considered, the temperature "T" and the holding time "t" where each parameter at two levels (min, max). These treatments were applied on forged XC38 steel samples, the obtained results have resulted in a mathematical model evaluating the surface hardness "Hv" as a function of treatment temperature and holding time. The experimental results indicate for this steel that holding time minimum and temperature minimum (t = 2h, T = 850 °c) have an apparent significant effect where "Hv" achieved the value of 750 (Hvi = 179).
Keywords: Heat treatment, superficial hardness, factorial designs, mathematical model.

Simulation and Modeling of Uncertainties in the Calibration of an Fluorescence Chemical Spectrometer (FRX)

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Abstract. Sensitivity analysis and uncertainty estimation are of major importance for the declaration of conformity of finished products. Models must be sought to analyze the test data. The main objective of this work is to establish reliable models to analyze our experimental data and validate them. So we have studied and used the Monte Carlo and Bootstrap simulation methods, we have been able to realize programs that calculate the uncertainty according to the

ISO 8466 standard on X-ray fluorescence spectrometer samples from the URASM CRTI chemical analysis laboratory. Programs and interfaces are made with Matlab (GUI).

Keywords: simulation; uncertainties; Monte carlo; Bootstrap; calibration

Topic 2

Metallic materials, ceramics and composites: Elaboration, forming, phase transformations, simulation

Thermodynamic Assessement of the Ga-Y Systems Supported by Ab-Initio Calculations

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Abstract. Thermodynamic modeling of the Ga–Y systems was performed based on the available Experimental information and first-principles calculations. Enthalpies of formation for the compounds (Ga-Y;GaY2;Ga3Y5) at 0K were computed by ab initio methods, The CALPHAD assessment of Ga-Y system was then performed by considering both .The ab-initio computed enthalpies of formation and the experimental phase equilibrium data.
Keywords : CALPHAD; ab-initio calculations; Ga-Y system; phase diagram.

Thermodynamic Optimization of the Lanthanum-Silicon System

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Abstract. The industry is demanding ever more complex alloys for applications that require more and more powerful physical characteristics. The knowledge of the physicochemical properties of such materials firstly requires the determination of their thermodynamic quantities and then the prediction of the evolution of their thermomechanical properties during industrial use.The complete characterization of the system is only established with the description of all its thermodynamic quantities. This is possible because of its modeling because it precisely writes, for all these phases, the free enthalpy that contains all the thermodynamic information.Our work consists in studying the binary system (Si-La) which has six defined compounds: La_5Si_3, La_3Si_2, La_5Si_4, LaSi, $LaSi_{2\text{-}a1}$, $LaSi_{2\text{-}a2}$ by the CALPHAD (Calculation of Phase Diagrams) method. The optimization of the thermodynamic functions and the restitution of the phase equilibrium diagrams is carried out thanks to the software BATNABIN, this program is based on the collection of an incomplete set of the experimental data and the modeling of the free enthalpy of each existing phase in the system. The Redlich-Kister model is used to describe the free excess enthalpy of non-stoichiometric phases.This study gave very satisfactory results for either phase diagrams or thermodynamic quantities in comparison with the experimental data of the literature.
Keywords : Phase diagram, Si-La system, thermodynamics, binary alloys, CALPHAD.

FEM simulations of strain homogeneity for the 6063 aluminium alloys processed by ECAP

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Abstract. The uniformity of plastic strain distribution in a workpiece 6063 Aluminum alloy after Equal Channel Angular Pressing (ECAP) was studied using a 2D DEFORM finite elements software. The treatment parameters including the angle of intersection of the channel ϕ, the speed of pressing, the friction have varied to study their

effects on the strain homogeneity. It was found that a single ECAP pass was unable to produce homogenous strains in a workpiece, although strain distribution can be improved by selecting the appropriate processing parameters.
Keywords : ECAP, finite element, DEFORM, deformation homogeneity, ECAP parameters.

Study of the oxygen reduction reaction on the Ln2-xSrxNi1-yCoyO4± δ material; Synthesis and Electrochemical Study

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Abstract. The oxygen molecule is most abundant in the earth's crust [1].The oxygen reduction reaction (ORR) is important, on the one hand in the variety of the electrochemical processes and technologies, including corrosion (and the inhibition of corrosion), sensors, fuel cells [2], metal-air batteries [3-6], the cathodes depolarized by air [7] and on the other hand with the production of the oxidant [8]. ORR, the cathode is one of the most important factors influencing the performance of a fuel cell and efficient electrocatalysts are crucial to the occurrence of the ORR with the desired current density, overpotentieland the stability [9-11]. There exist several reviews of the literature on this subject [12-14]. However, the mechanism of the reaction is always controversial. The kinetics of this reaction as well as its mechanism depends on several factors especially the electrolytic medium, the surface structure [15-18], pH and the media type. A great number of materials of electrodes has until now been studied for the ORR. The latter was strongly studied in the years 1960-1970 epergnes for the development of the fuel cells at low temperature. Knowing that the slow kinetics of the ORR is largely responsible for the losses of tension in the fuel cells at low temperature [19, 4].

Study of the mechanical behavior of a Sandwiche pipe in buckling under axial compression in the presence of internal crack in core

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Abstract. On the basis of an adapted modelization of mechanical type of the rupture, it is possible to predict by numerical simulation the residual behavior of the shell damaged or shell containing manufacturing defects, in the field of buckling. Using the finit element method, this study aims to find the load factor of a cylindrical shell made of sandwich composite material. In one part, we show the influence of the internal crack geometric defect on the load factor and consequently on the mechanical behavior in buckling. We have shown that for internal crack, the presence of this defect in the core leads to the fatal deterioration of the pipe. The paces for load factors have a maximum peak of charge. Thus, the height of the circular or semi-circular internal crack has an influence on the load factor. The mechanical buckling behavior is similar for all defects lengths greater than 100 mm, and its increase causes a decrease in the load factor for semi-circular internal crack. Beside, the load factor values for circular internal crack are the weakest.
Keywords : Load factor of buckling; Internal crack; Sandwich pipe; Finit elements Analysis.

Study of the mechanical behavior of a Sandwiche pipe in buckling under axial compression in the presence of circular notch internal crack

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Abstract. On the basis of a adapted model of mechanical type of the rupture, it is possible to predict by numerical simulation the residual behavior of the shell damaged or shell containing manufacturing defects, in the field of buckling. Using the finit element method, this study aims to find the load factor of a cylindrical shell made of sandwich composite material. In one part we show the influence of the notch internal crack geometric defect on the load factor and consequently on the mechanical behavior in buckling. We have shown that for notch internal crack, the orientation of the pipe plies has an influence on the load factor, and its increase causes the increase of the load factor to maximum values when the ply is at 75^{O}. The presence of this defect in the core leads to the fatal deterioration of the pipe. The paces of load factors in the case of defects greater than 0.1 m in diameter have two peaks loads.
Keywords: Load factor of buckling; Internal crack; Sandwich pipe; Finit elements Analysis.

Study of the mechanical behavior of a Sandwiche pipe in buckling under axial compression in the presence of internal crack in different plies

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Abstract. On the basis of an adapted modelization of mechanical type of the rupture, it is possible to predict by numerical simulation the residual behavior of the shell damaged or shell containing manufacturing defects, in the field of buckling. Using the finit element method, this study aims to find the load factor of a cylindrical shell made of sandwich composite material. In one part, we show the influence of the internal crack geometric defect on the load factor and consequently on the mechanical behavior in buckling. We have shown that for the height of the circular or semi-circular internal crack position in plies has an influence on the load factor. The mechanical buckling behavior is similar for all defects height and its increase causes the decrease of the load factor for semi-circular internal crack in plies, and the load factor values of internal crack in plies of the outer layer of pipe. Beside, the load factor values for circular internal crack are the weakest.
Keywords: Load factor of buckling; Internal crack; Sandwich pipe; Finit elements Analysis.

Effect of normal loads and sliding velocities on friction coefficient of steel sliding against different materials

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Abstract. In the present research, friction coefficients of steel sliding against different materials are investigated and compared. Using CSM tribometer. Experiments are carried out when different types of samples such as aluminum and brass slide on steel pin. Experiments are conducted at normal load 3,5,8 and 10 N, sliding velocity 0.24, 0.35 and 0.48 m/s. Variations of friction coefficient with the duration of friction at different normal load and sliding velocity are investigated. Results show that the friction coefficient decreases with the increase of normal load and sliding velocity for all the tested pairs. On the other hand, it is also found that the mass loss increase with the increase of normal load and sliding velocity.
Keywords : Friction coefficient, Normal load, Sliding speed, Mass loss.

Elaboration of cordierite SiC composites prepared from local low cost materials

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Abstract. The objective of the present work is to explore the possibility to synthesize low cost cordierite ceramic materials from Algerian kaolinite, a natural low-cost and abundant raw material, magnesia and synthetic Silicon Carbide (SiC) to synthesise Cordierite SiC composites ceramics through reaction sintering and investigate the phase transformation and sintering behavior of the composites. The raw powder mixtures were wet ball milled in a planetary ball mill. Each mixtures were prepared to obtain 100/00 (wt,%) and 80/20 Cordierite SiC composites. The samples were sintered at 1200, 1250, 1300, 1350 and 1400°C for 2 h. The bulk density of the samples was determined using Archimedes principle. X-ray diffraction, and scanning electron microscopy complementary techniques were used to characterize the phases transformation and densification behavior of Cordierite SiC composites.
Keywords: composite, Cordierite, Phase transformation

High temperature magnetotransport properties of the double layered manganite: $(La,Sm,Ca,Pb)_3Mn_2O_7$

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Abstract. Structural, microstructural and magnetotransport properties of the polycrystalline double layered manganite LaSm0.4Ca1.5Pb0.1Mn2O7, prepared by conventional solid state reaction, were studied. It crystallized mainly in a tetragonal phase with space group I4/mmm. Scanning electron microscope (SEM) micrograph shows a granular character, with open porosity and grain size estimated as 1 to 4 µm. X-ray energy dispersive spectroscopy (EDS) shows the high purity of the sample. Temperature dependent of electrical resistivity is carried out between 20 and 260 K. It exhibits, a double metal-insulator transition (MI) at 98 and 68 K. Applied magnetic field exhibits a decrease of resistivity values presenting, so a magnetoresistive (MR) behavior. Magnetoresistance (MR) curve shows a monotonically decrease between 98 K and 260K from 11% to -6% under 1 Tesla. The resistivity curves above Debye temperature are well fitted by 3D variable rang hopping (3D-VRH) model and corresponding estimated values of mean hopping distance (Rh (T)), mean hopping energy (Eh (T)) and density of states near the Fermi level (N(EF)) (DOS) are discussed.
Keywords : double layered manganites; electrical resistivity; metal-insulator transition; magnetoresistance; 3D variable range hopping.

Modeling of mixing at the interface of metallic multilayers under swift heavy ion irradiation

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Abstract. The behavior of the metallic multilayer Au100Å/Si100Å/Si under swift heavy ion irradiation has been studied in the frame of the inelastic thermal spike model. The Au has been chosen as insensitive material regarding the

irradiation. The heat transport in the electronic and lattice subsystems have been simulated using the 3 dimensions numerical code including the energy transfer between the layers in the direction perpendicular to the surface of the layers. The simulations have been done for four kinds of ions Pb, Xe, Kr and Ar at a specific energy of 3Mev/uma. The results show that for the ions Pb, Xe and Kr an intermixing at the interface of Au/Si has been obtained. While with Ar ion no mixing has been observed at the interface of this multilayer.

Keywords : Irradiation; Swift heavy ions; Thermal spike model; Ion beam mixing.

The effect of quenching and tempering on the tribological behavior of AISI 4340 steel

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Abstract. The AISI 4340 steel has a main position in many industrial applications because of its good mechanical properties. In some components like gears and shafts, AISI 4340 steel need to have good mechanical and tribological properties. In this paper we will investigate the tribological properties of quenched and tempered AISI 4340 steel. For this purpose, a ball-on- disk tribometer was used. Also, an optical microscopy was used to show the microstructure and the sliding track of the samples. The hardness was measured using a Rockwell hardness indentation. The results showed that quenched and tempered AISI 4340 steel exhibited a best wear resistance and hardness properties than as received one.

Keywords : AISI 4340 steel, Wear resistance, Hardness, Heat treatment, Friction.

ELABORATION AND CHARACTERIZATION OF CU_2O THIN FILMS IN A COPPER ACETATE BATH

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Abstract. Nanotechnology is a multidisciplinary field of research and development based on the knowledge and mastery of the infinitely small. The passage of matter to nanometric dimensions reveals unexpected properties that are often totally different from those of the same materials at the micro or macroscopic scale, particularly in terms of mechanical resistance, chemical reactivity, electrical conductivity and fluorescence. Indeed, many scientific works in the field of synthesis and characterization of nanoparticles in a general manner and more particularly based on metals, have demonstrated the remarkable properties of these nanostructures in various fields such as, optoelectronics, microelectronics and electrocatalysis [1, 2].

Several methods have been developed, including physical methods, such as evaporation or spraying, and chemical, vapor or liquid methods [3, 4]. Physical methods are often restrictive and relatively expensive because they require very heavy equipment and very specific working conditions (vacuum, substrate temperature, deposition rate, etc.). Among the techniques for developing thin layers, the electrochemical pathway has the possibility of depositing different materials as well as obtaining different microstructures according to the deposition parameters used [5].

Cu_2O cuprous oxide has attracted the attention of the scientific community because of its possible applications in various fields due to its chemical inertness and excellent stability, low production cost, good electrical properties, high refractive index and because of advantages related to the properties of its surface. The natural abundance of its basic materials makes it possible to mass produce it and its non-toxicity is an important factor in terms of sustainable development [6].

The purpose of this work is to prepare a Cu2O thin film by electrochemical deposition from an acetate bath on a titanium substrate. The effect of electroplating time on the structure, composition and morphology of the deposit was investigated using X-ray diffraction (XRD) and scanning electron microscopy (SEM). The results indicate the formation of a thin Cu_2O film of pure cuprous oxide at reduced electrodeposition times and a thin film of Cu_2O oxide decorated with Cu (Cu_2O / Cu) nanoparticles at times of high electrodeposition.
Keywords : Cu_2O; Electrodeposition; thin films.

Study of the Alumina thin films deposited by RF magnetron sputtering. The effect of substrate bias

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Abstract. The thin films of aluminum oxide (Al2O3) have excellent properties such as: high melting point, high hardness, medium refractive index, high transparency, low absorption, wide band gap, a high thermal conductivity, low electrical conductivity, and high radiation resistance, good corrosion resistance with chemical and thermal stability. According to their excellent mechanical, optical and electrical properties, thin films of aluminum oxide are used in a very wide range of applications, for example as wear-resistant coatings, corrosion-resistant barriers , optical waveguides and passivation layers in metal oxide semiconductor (MOS). In this work, thin films of alumina (Al2O3) were deposited on substrates: glass, silicon and steel 316L, by magnetron RF sputtering in a mixed gas of argon and oxygen fractions was varied ranging from 1.25 to 10% at low pressure and different substrate bias(0v to -100V). These layers were characterized by X diffraction radiation, Raman spectroscopy and nanoindentation.
Keywords : Ceramic, Thin films, Alumina, PVD.

Effect Of Load On Dry Sliding Tribological Properties Of ternary Borides Against Al2O3

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Abstract. Herein we study the friction and wear behavior of a ternary transition metal ceramic, prepared by HP (Hot Pressing) sintering. The MAB Phases are nano-layered ternary ceramics, newly synthesized, which combines some of the best properties of metals and ceramics, which include high bulk moduli, excellent thermal and electrical conductivities, good thermal shock resistance. In this paper, we report the tribological behavior under dry sliding conditions against Al2O3 ball, using a ball on disc tribometer. SEM analysis were applied to examine the wear track and identify the different wear mechanisms. The results showed a high friction coefficient but relatively a low wear rate.
Keywords : Nanolayered; ceramics; Ternary borides; Wear; Friction.

Wood flour biocomposites based on recycled polyethylene terephthalate/polypropylene blend: effect of high filler loading on morphology and mechanical properties

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Abstract. Wood flour (WF)-filled composites based on a polypropylene (PP)/recycled polyethylene terephthalate (r-PET) matrix were prepared using two-step extrusion. Maleic anhydride grafted polypropylene (MAPP) was added to improve the compatibility between polymer matrices and WF. The effects of filler and MAPP compatibilization on the water absorption, mechanical properties, and morphological features of PP/r-PET/WF composites were investigated. The addition of MAPP significantly improved mechanical properties such as tensile strength, flexural strength, tensile modulus, and flexural modulus compared with uncompatibilized composites, but decreased elongation at break. Scanning electron microscopic images of fracture surface specimens revealed better interfacial interaction between WF and polymer matrix for MAPP-compatibilized PP/rPET/WF composites. These results indicated that MAPP acts as an effective compatibilizer in PP/r-PET/WF composites.
Keywords : Wood flour, polypropylene, recycled poly(ethylene terephtalate), composites, compatibilization, mechanical properties.

Elaboration and characterization of novel Metal Matrix composites reinforced with MAX phases particulates

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Abstract. in this paper, we report for the first time synthesis and characterization of novel MAX phases (Ti_3SiC_2, Ti_2AlC) reinforced Ni-matrix and Ti_2AlC reinforced Al-matrix. The stability of MAX phases in Al-matrix and Ni-matrix at a temperature of 1080°C has been investigated. All the composites were cold pressed and sintered at a temperature of 1080°C for 4 hours in H_2 environment. Microstructure analysis by scanning electron microscopy and phase analysis by X-Ray diffraction confirmed that there was minimal interfacial reaction between MAX particles and Ni, thus Al/MAX samples shown that MAX phases was totally decomposed at 1080°C. The Addition of MAX enhanced the Al-matrix and Ni-matrix
Keywords : ***MAX Phases, Synthesis, Nickel composites, Aluminium composites.***

Effect of modeling type of mobile loads on the dynamic behavior of bridges

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Abstract. The methods of modeling of structures have become very varied today, in the field of the modeling of the mobile loads who solicits the bridges structures,the D.T.R and the booklet 61 [1] presents the types of the mobile loads which can solicited the bridges,among these loads we find the trucks type BC,this type of loading is modeled in computational software such as the Csi Bridge as it is, because it is a three-dimensional model,on the other hand, in other type of modeling for example with finite element method and especially when we propose a uni-dimensional models as a beam, this is not possible.
The aim of this work is to present the influence of the model type of the mobiles loads (real load BC or by resultant) in the Csi bridge model taking into consideration the position of the loads on the bridge, or by resultant force for the finite element model, on the dynamic behavior ofthe bridge.
Keywords : Modeling of bridges, mobiles loads, models of bridge loads, finite element model, CSI bridge model, dynamic response.

ON TRANSITION METALS SULPHIDES PRECIPITATION IN ALLOYED STEELS

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Abstract. The mechanical properties of alloyed steels parts are improved following specific thermal and/or thermo-chemical treatments. This improvement is the result of the precipitation of simple and/or complex chemical combinations (carbides, nitrides, borides and/or carbonitrides, borocarbides). Nevertheless, the apparition of transition metals sulphides (TMSs) is a phenomenon that steelmakers try to avoid because of the negative influence of these chemical combinations on the material properties. TMSs precipitation in alloyed steels was the object of several theoretical studies (phenomenological description, thermodynamical and/or kinetical approaches) and remains an immense field of investigation.
In this study, our theoretical approach to this phenomenon is carried out by respecting the rules of non-dimensional mathematical analysis. We propose a relative ranking of the transition metals (TMs) sulphidising ability and models to computing any TMS amount (mass fraction) and relative content in the metallic structure of Fe-C alloys. Computed values allowed the sorting/ranking of all TMs regarding this reaction. Results confirmed that manganese is the element with the highest aptitude to form its corresponding sulphide (MnS) in Fe-C alloys (whatever its chemical composition, i.e: even in the presence of other quantitative alloying elements).
Keywords : Alloyed steels, non-dimensional analysis, transition metals, sulphides

MOLDING DIRECTION INFLUENCE ON THE MECHANICAL BEHAVIOR OF FRAGILE MATERIALS.

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Abstract. This study based from studying the influence of the direction of molding on the mechanical behavior of fragile material passes by the development of the test-tubes or level of company ONNAPH of Annada, Algérie. The curves obtained starting from the deflection tests 3 points show 3 phases. One can notice that to leave the values stresses the rupture as those of the Young modulus obtained in the oblique direction are higher than those obtained in the direction of the molding and the perpendicular to the molding. The cracking and damage mechanisms were analyzed using a microscopic observation of the morphology of the product what made it possible to make a correlation with macroscopic measurements. The application of the probabilistic model of Weibull made it possible to

identify the parameter of heterogeneity or module of Weibull for all the directions of molding as well as the constraint of standardization.

Keywords : Inflection 3 points; fabric; cracking; models probabilistic of Weibull.

Hygrothermal effect on the moisture absorption in composite laminates with transverse cracks and delamination

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Abstract. The stiffness degradation of the cross-ply composite laminates containing a transverse cracking and delamination in 90° layer is predicted by using a modified shear-lag model by introducing the stress perturbation function. The prediction shows better agreement with the experimental results published by Ogihara and Takeda 1995, especially for laminates with thicker 90°plies in which extensive delamination occurs. A homogenised analytic model for average transient moisture uptake in composite laminates containing periodically distributed matrix cracks and delamination is presented. It is shown that the model well describes the moisture absorption in a cross-ply composite laminate containing periodically distributed transverse matrix cracks in the 90° plies. The obtained results represent well the dependence of the stiffness degradation on the crack density, thickness ratio and moisture absorption. The present study has proved to be important to the understanding of the degradation of the material properties in the failure process when the laminates in which the delamination grows extensively.

Keywords— Delamination; Stiffness; Hygrothermal effect; Absorption, matrix cracks.

First principles calculations of structural, electronic and optical properties of Boron and Aluminumcompounds

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Abstract. We present first principles calculations of the structural, electronic and opticalproperties of the BAs, BN, AlAs and AlNcompounds, using the full potential-linearized augmented plane wave method (FP-LAPW) within the density functional theory (DFT). The structural properties are investigated using the Wu–Cohen generalized gradient approximation. For band structure calculations, both Wu–Cohen generalized gradient approximation and modified Becke-Johnson of the exchange-correlation energy and potential, respectively, are used. Finally, For the optical properties, the refractive index and the dielectric constant was calculated and studied by using the above method.

Keywords :FP-LAPW method, Boron compounds, Aluminumcompounds, band-structure,optical properties.

Large negative magnetoresistance and 3D-Variable range hopping in $Gd_{1.2}Ca_{1.8}Mn_2O_7$ compound

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Abstract.The $Gd_{1.2}Ca_{1.8}Mn_2O_7$ compound is synthesized by solid state reaction. It crystallized mainly in tetragonal structure with I4/mmm space group. A simple perovskite, which crystallized in orthorhombic structure with Pbnm

space group, is detected as a secondary phase. SEM micrographs show the granular character of the sample and grain size was found to be between 2 and 7 µm. The resistivity curves present a double metal-to-insulator transition T_{MI} and show magnétorésistif character. A small shift of the second T_{MI} was observed after applied 2 Tesla of magnetic field. The magnetoresistance reaches the 160 % value under 2 Tesla at 180 K. The resistivity behavior of the samples is governed by 3D-variable range hopping mechanism. Mean hopping distance $R_h(T)$ and mean hopping energy E_h (T) were carried out. $R_h(T)$ decreases and E_h (T) increases with temperature, which is the main characteristic of the VRH mechanism.

Keywords—double layered manganites; electrical resistivity; metal-insulator transition; magnetoresistance; 3D variable range hopping.

Dielectric and impedance spectroscopy characterizations of CuO added $(Na_{0.5}Bi_{0.5})0.94Ba_{0.06}TiO_3$ lead-free piezoelectric ceramics

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ABSTRACT. CuO was used to reduce the sintering temperature of (Na0.5Bi0.5)0.94–Ba0.06TiO3 + 0.03 wt.%Sm2O3 (named NBTS) piezoelectric ceramics. Structural/micro-structural, dielectric, and resistive properties of this composition have been studied using impedance spectroscopic method to get better understanding of (i) the electrical conduction and dielectric relaxation mechanism and (ii) microstructure-electrical properties relationship of the materials as a function of temperature and frequency. The XRD patterns reveal the presence of the morphotropic phase MPB (coexistence of tetragonal and rhombohedral phase) for different compositions. Dielectric and complex impedance spectroscopic studies were carried out in a wide frequency (i.e., 102–106 Hz) and temperature (30–500 °C) range. The maximum of permittivity (at transition temperature) was found to decrease with increasing CuO amount in NBTS, but the diffuseness of dielectric peak increases. The nature of frequency dependence of AC conductivity of NBTS follows the Jonscher power law, and calculated DC conductivity follows Arrhenius behavior. The Nyquist plots suggest that the grains only are responsible for the conduction mechanism of the materials. The occurrence of single arc in the complex modulus spectrum of NBTS compositions confirms the single-phase characteristics, and also confirms the presence of non-Debye type of multiple relaxations in the material.

KEYWORDS: (Bi0.5Na0.5)0.94Ba0.06TiO3 ; Low sintering temperature; Lead-free piezo-ceramics; AC impedance spectroscopy; Dielectric relaxation; Conductivity.

Valorization of white Algerian kaolin in the preparation of the glazes sanitary ware ceramics

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Abstract .The work reported here involves the preparation and characterization of ceramic glazes made from combinations of different raw materials. In this study, Kaolin DD1 which is clay Algerian was investigated for use in the making of ceramic glazes. The chemical and the mineralogical investigations indicated that major constituents of the Kaolin DD1 were sodium aluminium silicate hydrate. The production of the sanitary ware glazes was done using low cost materials such as Kaolin DD1. The glazes prepared by conventional ceramic processing at temperature of 1250 ◦C, infra-red spectroscopy and X-ray diffraction revealed that the opacity was caused by crystals formed during thermal treatment, the Chemical durability of glazes was investigated experimentally, The highest whiteness parameters (89.15 – 93.58%) are registered, which have the SiO_2 /Al_2O_3 ratio equal to 9.3-10.94 and low porosity(<0.75). a maximal flexural strength (65.03MPa) This obtained flexural strength value is drastically higher than that achieved for sanitary ware glazes (ranged between 30 and 40 MPa). These properties are compatible with

those of commercial glazes for sanitary ware. In other words, the presence of kaolin DD1 in their product well confirm the benefic effect of the used raw material on sanitary ware glazes. KEYWORDS: GLAZE; CERAMIC SANITARY WARE; ALGERIAN KAOLIN; SEGER METHOD; WHITENESS;

Investigating the Ni/ZrO2 nanocomposites properties: Influence of calcination temperature

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Abstract. The incorporation of metal nanoparticles in oxides makes it possible to combine the new properties of the divided metals with the mechanical, thermal and electrical characteristics of the oxide support. This changes its texture and enhanced its mechanical and thermal resistance. The combinationof all these properties makes the nanocomposites metal / oxide the best choice for various applications.

In this work we aimtoinvestigate andenhance the properties (structural, optical, magnetic, electronic ...) of ultra-divided materials(specificallythe nickel nanoparticles supported over zirconia), which are the object of spectacular applications in various fields. like catalysis (petrochemistry), fuel cells (stored energy), nuclear (coatings), ... etc. The Ni/ZrO2nanocompositeswere prepared by the wet impregnation method, followed by calcinationat various temperatures (150°C, 350°C, 550°C, and 750°C). Various techniques were used to characterize the prepared samples (MEB, DRX, UV-visible absorption, FTIR).

The DRX spectra of the calcined samples at T=550°C and T=750 °C indicatedthe presence of new phases ($NiZr_2$, $Ni_{0.99}$ $Zr_{0.01}$,NiO). The first and most intense phase corresponds to the phase $NiZr_2$. Although, for the samples calcinedatT=750°C, theDRX data revealed the disappearance of thisphase. However, it showed the appearance of the phase Ni $_{0.99}Zr_{0.01}$with a low intensity for the same samples.

Moreover the UV-Vis spectra showed the disappearance of nickel ions $Ni^{+2}$and the appearance of the ions Ni^{+3}instead of previous onesfor the calcined samples at 550°C.They also indicated the reappearance of the ions Ni^{+2} at T=750°C.

Finally,the FTIR spectra determined that most of the vibrations refer to the bonds between elements forming the nanocomposite.

Key words: Nanocomposite, Interaction metal/oxide, nickel Ni, support oxide, m-ZrO_2, catalysts.

The influence of plastic waste fibers in improving the properties of concrete

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Abstract.Plastics have become an inseparable and integral part of our lives. The amount of plastics consumed annually has increased steadily. The use of plastic waste in the construction industry has two glaring dividends, the environmental impact is addressed by the disposal of this waste and, secondly, the economic impact.

This work focuses on the recovery of a waste that is harmful to the environment because of its cumbersome and unsightly nature it is plastic waste.

From the experimental results it can be concluded that concrete reinforcement with plastic fibers shows a marked improvement in the flexural strength of concrete and the compressive strength was evaluated at 92%, 88% and 82% relative to to control concrete at 7, 14 and 28 days.

Key words: waste recovery, concrete, plastic waste, resistance.

Study of the repair of the pipes damaged by patch in composites

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Abstract - Work presented is a contribution to the study of the quality of the tubes intended for the construction of the pipelines, in this study the finite element method is used to analyze the behavior of the cracks repaired with patchs in composites by calculating the stress intensity factors and the integral J at a peak of crack in elastic and elastoplastic behaviour. The effects of the properties of the crack and the adhesive and the pipe on the variation of the factors the intensity of constraint and the integral J were highlighted the results obtained show the optimization of unquestionable factor to improve quality of repair for a beneficial effect on the reduction of the constraints of deformation and the delay of the propagation of the cracks.
Key words - pipeline ; finite element method ;patch in composites; fissure ;stress intensity factor ;integrale J ;plastic ; elastoplastic.

Effect of a crack emanating from notch on a composite pipe subjected to buckling

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Abstract.For a better construction, new pipelines performance made of composite materials is necessary to make the right choice of the composite and its mechanical properties. New recommendations for sizing stratified pipes have been proposed with different combinations of loads.
In this study, buckling analysis was performed on laminated composite pipes provided with square notches and for the case of a crack emanating from notch, using numerical simulation.
The results show that the size of the notch is important to the stability of the structure. We also note that it is strongly affected when the orientation is 20 °.
The crack length has no effect on the buckling factor for the inclinations of the crack (α = 0 ° and α = 90 °), to the inclination α = 45 °, the size of the crack has an effect material on the destabilization of the structure and that in the interval [0 °, 40 °], beyond this stack, and from θ = 40 °, it had no significant effect.
Keywords: squared notch, buckling, pipes in laminated composite, finite element analysis method.

Calculation of Cosegregation Energy in CFC Structural Metallic Alloys: ATOMISTIC APPROACH.

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Abstract. Many properties of metals and alloys depend on the structure and chemical composition of the defects. The segregation behavior of grain boundaries and surfaces is addressed by the calculation of cosegregation energies, local pressures, and relative volume variations of atomic sites.
The site co-segregation energies of interfacial structures are computed by numerical simulation in quenched molecular dynamics.
Solvent-Solute or Impurity-Matrix pairs are a combination of two of the four metals: Nickel (Ni), Copper (Cu), Silver (Ag) and Gold (Au), all of CFC structure. The ratio of the atomic rays of the solute (Impurity), rI, to that of the solvent (Matrix), rM, varies from 1.16 to 0.86. These ratios are greater than 1, respectively less than 1, for systems called "direct", respectively "inverse". The Ni-Ag and Cu-Ag systems, where the difference between rays is very large, show a strong tendency towards phase separation. For the Ni-Cu and Au-Ag systems, where this difference becomes small, there is total miscibility.

In this study, we consider the four systems, Ni (Ag), Cu (Ag), Ni (Cu) and Au (Ag), Ni- (Ag), and grain boundary∑19a (331). Recall that this joint has been observed and studied at the atomic scale with a perfect agreement between the structure simulation and the electron microscopic observation in high resolution transmission in a nickel bicrystal.
The objective of this study is the validation of the driving force model that involves the contributions of size effect, the effect of excess cohesion.
The extension of the study to multi segregation allows us to compare these results with those obtained for mono segregation.
Then a comparison of the co-segregation between two other types of joints, one symmetrical type Σ11 (113) and the other asymmetric type Σ11 (332).
Keywords: Grain boundary, Surface, Segregation, Metallic alloys, Simulation, Molecular dynamics.

Free Vibration Analysis of Laminated Hybrid Composite Plates With Central Cutouts

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Abstract. This study intends to investigate the vibration behavior of thick hybrid laminated composite plates with central cutouts using the *h*-version of the finite element (FEM) Package (ANSYS) based on the first order deformation theory. A convergence and comparison study with published data is done to show the efficiency and the accuracy of the ANSYS code for vibration problems of laminated composite plates. The effects of the diameter of circular cutouts, shape of cutouts, and boundary conditions on vibration frequencies are studied. It is found that these parameters has significant effects on the determination of natural frequencies, especially the boundary conditions case.
Keywords: free vibration;Hybrid laminated composite plates; h-version of the finite element method; central cutout;

Modal Analysis For Composite Sandwich Plates Of Honeycomb Core

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Abstract. The purpose of this work is to realize a vibratory study on panel's sandwiches established by the honeycomb core and aluminum skins, used in the conception of the aerospace structures; all the analyses are based on conditions in the embedded free limits (E-L-L-L). The aim is to compare the natural frequencies of the two plates with those obtained from the two simulation models. Two methods are used in modeling, 3D drawing of the sandwich structures and calculating an equivalent structure using the homogenization method based on representative elementary volume (REV) using ANSYS software. The modal resolution of these two configura-tions is performed by the finite element method. The comparison of numerical results shows excellent agreement
Keywords: sandwich plate, homogenization, FRF's , modal analysis, finite element method. Introduction (Heading 1).

Efficient Finite Element for Multilayer Composites Plates Bending Analysis

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Abstract. The aim of this work is to develop a quadrilateral finite element based on Reddy's third order shear deformation theory for the bending behavior analysis of composite laminated plates. The element is a C0 four-nodded

isoparametric with seven degrees of freedom at each node, three translation components, two rotations and two higher order rotational degrees. In particular, selective numerical integration is introduced in order to improve the results and to alleviate the locking phenomenon. The performance and reliability of the proposed formulation are demonstrated by comparing the author's results with those obtained using the three-dimensional elasticity theory, analytical solutions and other advanced finite element models.

Keywords: Third Order Shear Deformation Theory; Laminated Composite Plates; Finite Element; Bending Behavior.

Puzzle of c-WN phase stabilization

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Abstract. In this paper, we present first-principles calculations that compare structural and electronic properties of WN in the NaCl and NbO phases. Our results predict that the NbO structure of WN is more stable than the NaCl structure without defects, where the enthalpy of formation per formula unit Hf =-0.872eV and 0.616eV for NbO and NaCl structures, respectively.Moreover, the calculated lattice parameters of c-WN are a=4.35A° and a=4.11A° for NaCl and NbO phases, respectively. It is very clear that the lattice parameter obtained for c-WN in NbO is in very good concordance with that reported experimentally of a =4.14A° . Although the formation energy calculations support the hypothesis of the stability of the NbO phase, the experimental xray photoelectron spectroscopy (XPS) electron density of states for valence band spectra corresponds to that density of states calculated for c-WN in NaCl phase. Based on this comparison, more consideration must be taken into account to elucidate this issue.

Keywords: Cubic Tungsten nitride ceramics, Firstprinciples calculations, Formation energy.

Copper-polypyrrole composite films for bifunctional electrocatalysis and sensing of ascorbic acid

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Abstract. In this study, we have interested to the electrochemical deposition on an indium tin oxide (ITO) substrate of thin films of polypyrrole functionalized by a dispersion of copper particles. The resulting copper-polypyrrole/ITO modified electrodes were used for the development of an amperometric sensor allowing the detection of ascorbic acid at low concentration ranges. The surface morphology analysis of the obtained deposits showed a homogenous dispersion of copper particles on the polymer film. The electrochemical reactivity of the prepared modified electrode towards the oxidation of ascorbic acid was examined in a solution of 0.1 M pH 7.0 phosphate buffer using cyclic voltammetry and chronoamperometry methods. The catalytic behavior of this electrode manifests by an increase in the peak current of ascorbic acid oxidation as compared to the response of the pristine polypyrrole film; and by an increase in the oxidation current density with increasing the ascorbic acid concentration.

Keywords: ascorbic acid; electrocatalysis; polypyrrole; sensor; thin film.

Revealing the physical properties of Mg(Si,Ge)As2: first-principles calculations thin films solar cells application

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Abstract. In this work, we studied the structural, electronic and the linear optical properties of chalcopyrite materials based on $Mg(Si,Ge)As_2$ using *first-principles* methods to build a new structure of thin-films solar cells with enhanced performances. The computational package Wien2k based on the full potential linearized augmented plane wave method (FP-LAPW) is used to calculate the desired properties. For the calculation of the exchange and correlation potential (XC), we used the local density approximation (LDA) for the structural parameters. The semi-local Becke-Johnson (mBJ) potential and its modified form proposed by Tran- Blaha (TB-mBJ) were also used for electronic structures and the linear optical properties. The results obtained were compared with other theoretical and experimental works.
Keywords: DFT; FP-LAPW; wien2k; $Mg(Si,Ge)As_2$; Physical properties.

INFLUENCE OF TEMPERATURE AND PRESSURE ON THE PERFORMANCE PEM FUEL CELL TYPE NAFION 117

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Abstract.This study aims at studying the influence of pressures and temperatures on the power provided by one cell; a stack of 35 cells which constitutes a stage of a stack. The battery weighs about 43 kg and measures approximately (38 cm × 21 cm × 21 cm).PEM fuel cells consist of three main components an anode, usually with platinum-containing platinum or catalysts, a thin and solid polymer sheet that serves as an electrolyte and a cathode, also platinum-catalyzed, the flow of membrane Nafion™ 117.
Keywords: PEMFC, Model, Performance, Matlab Simulink.

Effect Of The Adhesive Layer On The Mechanical Behavior Of Structures Damaged And Reinforced By An Overlap Composite Patch

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Abstract—this study treats the technique of reinforcing aeronautical structures such as outer dressing of aircraft by gluing a composite patch. So we are interested for the analysis of the shear and normal stresses in the adhesive and composite patch part of the damaged and reinforced structure by bonding of a unidirectional composite, as well as the influence of the adhesive layer thickness. Bonding is performed on two side (double overlap joint) of the structure solicited in uni-axial traction. A good knowledge of the stresses state in this part, which represents the weakest link of the set (structure-patch-glue), makes it possible to design a better maintenance. For this reason, the effect of the adhesive layer on the evolution of its mechanical behavior has been taken into consideration. Unlike reinforcement and repair techniques by riveting and bolting, the results obtained showed that the use of composite carbon / epoxy patch bonded to an aluminum plate reinforced by silicon carbide particles (Al / SiC) by an epoxy resin (FM73) made it possible to ensure good joint and increase the tear resistance of the composite patch.
Keywords: adhesive layer, composite patch, doubles overlap,shear stress, joint.

Modeling and simulation of $In_{0.15}Ga_{0.85}$ N/GaN strain quantum well structure for solar cells application

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Abstract. Quantum well solar cells based on III-V nitride semiconductor materials are a great technological interest by means to their physical and optical properties. In this study the effect of quantum well number on the characteristics (J-V), (P-V) and efficiency for the structure GaN/$In_{0.15}$ $Ga_{0.85}$ N/ GaN was studied. our result showed that, the increase in the number of wells is accompanied by the increase of the light current density and the efficiency, for example with 50 wells we found J_{ight} = 14 (mA /cm^2) and a efficiency 28%.
Keywords: quantum well ; solar cells; GaN; InGaN

The influence of scale yielding conditions in the determination of the fracture load using both analytical and numerical approaches for the study of the elasto-static anti-plane problem of a crack in a semi-infinite strip containing a non-homogeneous zone

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Abstract. The elasto-static anti-plane problem of a crack in a semi-infinite strip containing a non-homogeneous zone was studied using two approaches. The first one consist on an analytical approach based on the solution of a Singular Integral Equation (SIE formulation) using the Dugdale-Barenblatt cohesive model and the second approach is a numerical method based on a finite element analysis using a bilinear cohesive model (FEM-CZM approach). The results were expressed in term of fracture load. The length of the developing cohesive zone ahead of the crack tip was deduced at the crack initiation. This critical length size which was normalized with the crack size is taken as a characteristic length for defining the small/large scale yielding conditions of the particular studied case. For the small cohesive zone sizes (small scale yielding conditions), the computed values of the fracture load show a small difference between analytical and numerical approaches. In the other hand for the case of large cohesive zone sizes, the obtained values of the fracture load show significant discrepancy between the two approaches.
Keywords: Crack, Singular Integral Equation, FEM, cohesive models, scale yielding conditions.

Determination of the elastic parameters for reinforced thermoplastic composite using the indentation technique

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Abstract. This work deals with the application of the macro-indentation technique to the determination of the elastic parameters of composite with polypropylene matrix and reinforced with ductile and brittle fibers. The aim is to obtain a representatives average values taking into account the influence of the holding time and type of the used reinforcement (ductile or brittle reinforcement) on the overall elastic modulus of the studied polymers. To do this, the diameter of the indenter used is chosen relatively large (diameter of 16 mm) and the load equal to 6 kN. The various results obtained made it possible to see the effects of the holding time and the type of reinforcements used on the evolution of the elastic modulus of the reinforced composite.
Keywords: thermoplastic composite; nacro-indentation test; viscoplastic behavior

Synthesis, characterization and structural study of perovskite ceramics for piezoelectric applications

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Abstract. In this work we have prepared lead-free ceramics $BaTiO_3$, $CaTiO_3$, $Ba_{0.85}Ca_{0.15}Ti_{0.9}Zr_{0.1}O_3$ successfully from different raw materials barium carbonate ($BaCO_3$) calcium carbonate ($CaCO_3$) dioxide of titanium (TiO_2) and zirconium dioxide (ZrO_2) by the conventional solid state reaction technique at different sintering temperatures. These materials are mixed for 6 hours and sintered at temperatures of 1200 °C to 1300 °C for 2 hours. The sintering temperature has been varied to study its effects on microstructure and structural properties. Structural parameters were analyzed using X-ray diffraction (XRD), scanning electron microscope (SEM). Differential thermal analysis coupled with thermogravimetric analysis (ATG-ATD) was performed mainly to follow the process of precursor decomposition and formation of the perovskite phase. The XRD analysis results clearly show the synthesis of the perovskite phase as well as highlighting the formation of the Ba_2TiO_4 phase in addition to the $BaTiO_3$ phase. The diffractogram obtained shows that the BCTZ symmetry is both tetragonal with a space group P4mm and orthorhombic with a space group R3m. The calculated phase rates are: 41% and 59%, respectively.
Key words: Lead free ceramics; synthesis; microstructure; perovskite.

Characterization of local mechanical behavior of TA6V weld sheet

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Abstract. The present work aims to study the local mechanical behavior of TA6V weld sheet. To this purpose, X-ray Diffraction (XRD), optical microscopy and nano-indentation measurements have been employed. The results highlight strong relationship between the hardness (HIT), Young's modulus (EIT) values and the microstructure of each zone and phase present along the weld joint. The HIT of the molten zone (MZ) is greater than that of the Heat affected zone (HAZ) and the base metal (MB) in the α phase, whereas it shows small values in the HAZ than that of MB in β phase.

Kinetic damage analysis of composite carbon fiber/epoxy

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Abstract. This work presents the results of the damage kinetic of carbon fiber / epoxy woven composite using the acoustic emission under tensile test. Three types of geometries are studied. Acoustic emission (AE) is a non-destructive testing technique consisting in measuring and interpreting the acoustic signature. For this investigation we focus on the dominant failure mechanisms in fiber reinforced structures consisting of matrix cracking, fiber breakage and fiber-matrix interface failure. Propagation of the waves in the material, measures made by the sensor and signal treatments made by the acquisition system modify the signal and the information it carries. We further present a model of the acoustic emission sensors used in experiments to simulate the influence of aperture effects. The simulated acoustic emission signals obtained are compared to experimentally measured waveforms during solicitation tests. The simulated signals of fiber-breakage, matrix-cracking and fiber-matrix interface failure show systematic agreement with the respective experimental signals.

Keywords: kinetic, damage, simulation.

Elaboration Of Laminated Composite Plates By The LRI Process

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Abstract. The aim of this work is the elaboration of laminated composite plates based on the LRI (liquid resin infusion process). This process makes it possible to produce lightweight composite plates, with the possibility of their applications in the structural parts production of various dimensions in many industrial sectors such as aeronautics, transport and building. In this process, the use of the adjustable temperature heating plate replaces the autoclaves required in the development of composites. In contrast to existing processes, it does not require high pressure during the polymerization phase. The infusion of the resin is also done automatically by a vacuum pump. In addition, because of the absence of a mold on the upper part, vacuum bag made of nylon or silicone is used.

Keywords: LCM : Liquid Composite Molding; LRI: Liquid Resin Infusion; laminated composite materials; vacuum pump; glass fiber; carbon fiber.

Chemical sensor array modeling : application to Quartz Micro Balance (QMB) sensors

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Abstract. The aim of this work is to develop analytical models for the thermodynamic equilibrium at the interfaces (gas mixture / Quarz Micro Balance sensor arrays based on conducting polymers). Differential equations, which describe the change in the partial sensitivities of the sensor array elements depending on the gas mixture components concentrations, and the sensor array parameters, have been developed. Moreover, the responses of the sensor array as a function of the concentrations of the gas mixture components have been modeled.

Description of the solid method of BaTiO3 ceramics elaborations

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Abstract. There are two major methods of the barium titanate ceramic BaTiO3 elaboration, the solid and the liquid methods (Hydrothermal, sol-gel processing, and Coprecipitation) [1, 2, 3].In this work, we present a theoretical study to describe the solid method of BaTiO3 elaboration, it is the most method used in the industry, because it is very economical, inexpensive and easier to implement.

Key words: BaTiO3 ceramic; elaborations; heat treatment; sintering; Solid-state reaction.

Computational study of Fe-doped SiO_2 composite nanoparticles

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Abstract. The geometries, relative stabilities, and electronic properties of small SinO2n (n= 1–4) clusters that are utilized in ceramic membranes were investigated by using density functional theory (DFT) at the B3LYP/LanL2DZ

level of theory, as well as the effects of doping of different iron concentrations on the properties of silica were given, which some Si atoms were replaced with Fe atoms.
The effects of the size and the concentration of iron all were shown to have a significant influence on the behavior of adsorption of SiO2 in the field of UV-vis.
It was found out that the increase in the size of nanoparticle was accompanied with a reduction in energy of formation and a stability of the clusters.
Our results are in good agreement with the experimental and theoretical results available.
Keywords: composite nanoparticles; iron doping; silica; clusters.

Effect of heat treatment temperature on the structural evolution of hot forged steel balls used for grinding raw material in cement industry

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Abstract. The raw material preparation sector such as cement works, the steel and mining sector is beginning to pay attention to forged balls as an alternative to the cast balls for their best use characteristics. The forging materials are stronger than the casting material because of their fiber structure. The forging technique, in contrast to the casting process, contributes to a significant improvement of ball wear behavior during the grinding process.
The wear behavior depends on several factors including the chemical composition of the alloy, the type of microstructure and the applied heat treatment. In this work we focus on the effect of austenitizing temperature on the type of the produced microstructure. Al the heat treatment parameters were fixed for all the samples except the austenitizing temperature. Three austenitizing temperatures are selected and a tempering at 250 °C with a holding time of one hour followed by cooling has been carried out. The study is carried out on medium micro-alloyed carbon steel intended for heat treatment.
To make clear the effect of the temperature on the microstructural transformation, several investigations were achieved. Optical and SEM microscopy was carried out to qualitatively characterize the phases A microstructural analysis using the Rietveld method was conducted to access, for each temperature, the type and proportion of phases as well as the crystallites size.
Keywords: Grinding balls, forging, heat treatment, characterization, XRD analysis, Rietveld refinement.

Electric study of Graphene oxide

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Abstract. The synthesis of Graphene has attracted intense scientific interest because of its exceptional structural, chemical and electrical proprerties over the part decade. The synthesis of graphene oxide was prepared by the modified Hummer's Method and the structure and morphological proprerties were caracterised by the X-Ray diffraction (XRD), the Fourrier transform infrared spectroscopy and the Raman spectra.
The electrical properties were measured by the technic of impedance spectroscopy for the range of frequency of 10 Hz and varing the temperature from the ambient to 873 K. The ac conductivity, dc conductivity, dielectric constant and loss factors were obtained from these measurements. Constant-phase elements (CPE) are used in equivalent electrical circuits for the fitting of experimental impedance data.

The frequency and temperature dependence of the electrical modulus as well as dielectric loss parameters have exhibited a relaxation character. The relaxation effects have been analyzed by the graphical method. From this analysis, it has been established that there is a spread of relaxation times. The results have been further discussed quantitatively with the aid of the data on spectroscopic properties. The ac-conductivity verifies the Jonscher Law.
Key words: Graphene oxide, synthesis, impedancemetry, modified Hummer's method.

BEHAVIOURS OF DEFORMATION AND RECRYSTALLIZATION OF 3% SILICON STEEL USING WEDGE-SHAPE SPECIMEN

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Abstract. Hot deformation and static recrystallization behaviours of a low carbon 3% Silicon steel, which is ferriticstructure at high temperatures, has been investigated using wedge-shape specimen with a single-pass hot rolling experiments. The hot-rolling tests were carried out at temperature of 900°C to 9mm thickness followed by holding at the same temperature (900°C). The volume fraction recrystallized increased with the increase in rolling reduction and holding time after rolling, although a plateau was observed in the relationship between the volume fraction recrystallized and the effective strain. The preferential area for the recrystallization was the previous grain boundaries, particularly triple points of boundaries where the strain was concentrated. An inhomogeneity of recrystallization in the transverse sections through the thickness of the deformed wedges was observed. It was concluded that in this fine grain size material of 3% Silicon steel, the knowledge of deformation and recrystallization behaviors needs better control of strain and temperature under wedge-shape material.
Keywords: 3% Silicon steel, wedge-shape specimen, hot rolling, deformation variables, dynamic recovery, static recovery, static recrystallization.

Experimental study of the thermomechanical behaviour of alumina silicaterefractory material elaboratedfrom Algerian kaolin

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Abstract. This work aims to study the thermomechanical behavior of an algerian kaolinitic clay. We started with the characterization of the raw material (DD1) of Djebel Debbagh -Guelma, in order to obtain a deep information about the microstructure of the material before and after a heat treatment, notably its crystallographic nature and the grains size and shape. The chemical composition and physical properties are reported. The mineralogical and chemical characteristics, based on X-ray diffraction (XRD) and scanning electron microscopy (SEM), were also carried out. The general behavior of the material with increasing temperature was analyzed through the various microstructure investigations and themal analysis.
Keywords: kaolin; Thermo-mechanical properties; Kaolinitic clays; elaboration.

Elaboration and characterization of Al-Fe alloy powder by Powder metallurgy

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Abstract. The application of the metal powder metallurgy process requires several fittings, particularly because of the mechanical properties (ductility, hardening), thermal and strongly (with a few exceptions, such as tungsten for example) of those of the ceramics treated by this type of method of elaboration. Thus, a non-oxidizing atmosphere is necessary for the sintering of most metallic materials. Sintered metal products are increasingly used in various industries due to mechanical properties (ductility, hardening), thermal and strongly resistance[1].
The present study consists of the development of a mixture of aluminum-infiltrated steel aggregates. The study of the development of inters metallic Fe-Al compounds by sintering. After developing different characterization

techniques have been used such as optical and scanning electron microscopy, EDX analysis, micro hardness and wear tests.

Key words: sintering, Al and Fe powders, powder metallurgy, friction coefficient.

Topic 3

Corrosion and materials protection, pitting corrosion, stress corrosion, coating, thin films.

Corrosion resistance of electrodeposited nickel coating containing Cr2O3 particles

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Abstract. The objective of this work is the characterisation of the composite deposits Ni-Cr_2O_3 on copper substrate; these deposits are obtained from bath of electro-deposition of nickel watts.
The different electrodeposited layers are characterized by various analytical techniques: adhesion quality, corrosion tests in a solution of 3.5% NaCl, the techniques used are those of mass loss, polarization and impedance spectroscopy, Vickers microhardness, morphology by scanning electron microscopy Followed by a microanalysis (EDS) and X-ray diffraction.
The coatings prepared have a very good adhesion, are more resistant to corrosion, have a good hardness, a homogeneous and compact morphology and exhibit a high degree of codeposition of particles incorporated in the nickel matrix.

Keywords : Electrodeposition, Ni-Cr_2O_3, corrosion, Microhardness, morphology.

Investigation on the corrosion process of carbon steel coated by HVOF WC/Co/Crcermets in NaCl 3% solution

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Abstract. Mettalic coating are generally used to protect steel, in this context cermet coating are suggested for using in the marine environnement because of the absence of harmful element in their chimical composition.
We spent this research to study the electrochimicalbehaviour of cermet coating applied onto carbon steel, low alloy (35CD4) by thermal spraying technic in NaCl 3% by mean of stationary (E = f(T) ; log i = f(E)) et nostationary (electrochimical impedance spectroscopy) electrochimical methods. The results show the existence of a galvanic coupling between the coating and the substrate, and coated steel performs better in NaCl 3% than the uncoated steel.

Structural and mechanical properties of Cr-Me-N (Me= Zr, V) coatings

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Abstract. In this study Cr-N, Cr-Zr-N and Cr-V-N films were deposited by reactive magnetron process. The crystalline structures, morphology, mechanical and tribological properties of films as a function of Zr and V contents were investigated. The CrN films exhibit only a tow-phase microstructure, containing a cubic CrN phase and a hexagonal Cr2N phase, as evidenced by DRX. The results reveal that the mechanical properties of films were found to depend hardly on the Zr and V contents. As the Zr content increases, the dense and compact structure is developed with a low surface roughness; however the addition of V the rough surface was formed. Also, the mechanical properties including hardness (maximum hardness is 26 GPa) are largely improved in comparison with CrN and ZrN are largely improved in comparison with CrN and ZrN films. However the mechanical property was deteriorate with increasing of V content.

Keywords : CrN, Cr-Zr-N, Cr-V-N, Hardness, Wear property.

Corrosion resistance of Ni-P coatings in an aggressive environment

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Abstract. The aim of this work joins a study of the corrosion resistance by application of phosphorus nickel coatings deposited on the X52 steel substrates in (3.5 % NaCl) environment, using the stationary electrochemical method (polarization curves), and resulting the electrochemical parameters by the use of Volta- Master1.
The best coating of corrosion protection in our experiments is the use of phosphorus nickel composite coating which exhibits minimum values of corrosion current density and corrosion potential.
The results obtained by the stationary electrochemical method showed that the best nickel phosphorus coating which resists well corrosion is the one who elaborated at I = 0.10 A.
Keywords : Corrosion, Nickel, Phosphorus, Electrochemical, Volta-master1.

Monitoring the corrosion rate of mild steel in different aggressive media

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Abstract. This work focuses on the characterization of the electrochemical behaviour of mild steel ASTM A915 in industrial and rain water where the effect the role of anions as Cl^-, SO_4^{--}, NO_3^- was studied and is a part of a study devoted to the corrosion resistance of this substrate. Polarization curves and electrochemical impedance measurement were obtained for different experimental conditions in bulk electrolyte. DRX and Raman spectroscopy were used to analyze the passive films. At the corrosion potential, the substrate was in the passive state and the corrosion process was controlled by the properties of the passive films formed during exposure to the aggressive media expect in the presence of Cl- anions. Indeed, for chloride concentrations between 0.01 and 0.5M the results show an increase of the corrosion current densities and simultaneously a decrease of the compactness of the corrosion layer "C=Q/Icorr". EIS diagrams exhibited two relaxation times. When SO4-- were added to the electrolyte, it was found that the passive film was made mainly from Fe(II), Fe(OH)2, sulphate hydroxide with mixed valence Fe(II,III) or partially from green rust RV(SO42-). The obtained EIS diagrams show four relaxation times. The same results are obtained when the electrochemical test were conducted in rain water. This let us to conclude that the electrochemical behavior of the mild steel in both waters is much closer to that obtained in sulphated medium.
Keywords : Mild steel, d.c. Polarization, EIS, Water, Raman Spectroscopy.

Evaluation of Corrosion Inhibition ofgreen Inhibitor by electrochemical impedance of copper-nickel (90/10) alloy

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Abstract. Copper-nickel alloys are extensively used in marine applications and in desalination plants because of their good electrical and thermal conductivities, mechanical properties and corrosion resistance.
The objective of this study is evaluation of different concentration of green inhibitor with the alloy Cu-Ni (90/10) in sea water at the ambient temperature and identification of a critical concentration of inhibitor by the electrochemical methods such The electrochemical impedance (EIS).
Scanning electron microscopy (SEM)/ and dispersive analysis X in energy (EDS) were used to characterize the external products of corrosion.
All these studies indicate that the inhibitor reacts like an excellent inhibitor in the case of the alloy Cu-Ni (90/10).
Keywords : Corrosion, Cupper-nickel 90/10, green inhibitor;EIS,SEM, EDS, Sea water.

Influence of heat treatment on the morphological and optical properties of ZnO thin films synthesized by sol-gel technique

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Abstract.Pure zinc oxide thin films have been grown on glass substrates by sol-gel spin coating process. Effect of annealing temperature on surface morphologies and optical properties of ZnO thin films were investigated. The films morphological modification due to heat treatment was probed by atomic force microscopy which revealed that annealing roughened the surface of the film. The Optical transmittances were recorded in the wavelength range of 300–900 nm, and the films band gaps were determined. Waveguiding properties were measured by m-lines spectroscopy. The results indicated that our films are of good surface quality, highly transparent in the visible region and multimodes planar waveguides at 632.8 nm with a good confinement of the coupled light in the films.
Keywords : ZnO thin films; sol gel; annealing temperature; waveguide.

Sodium benzoate as a Corrosion Inhibitor for Mild Steel in 0.6MNaCl Solution

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Abstract. The inhibitive action of Sodium benzoate on mild steel corrosion in 0.6 M NaCl solution was studied using potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) techniques. The inhibition efficiency was found to increase with increase of the inhibitor concentrations due to the adsorption of the inhibitor molecules on the metal surface. The polarization curves indicate that sodium benzoate is an anodic inhibitor and we found that sodium benzoate is an excellent inhibitor for mild steel in 0.6 M NaCl medium and that its efficiency is greater than 97,97 % for a concentration 0.1M sodium benzoate.
Keywords : Mild steel; Corrosion; NaCl Solution; Corrosion inhibition; Sodium benzoate

Comparison of the semi-conducting properties of tin sulfide prepared by chemical and electrochemical methods

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Abstract.The semiconducting properties of tin sulfide prepared by chemical and electrochemical methods have been characterized by electrochemical impedance spectroscopy (EIS) and cyclic potentiodynamic polarization. The observation of the morphologie was done by scanning electron microscopy. Capacitance measurements have been employed to study the electronic properties of passive films. The first exhibit n-type semiconductor behavior and the second p-type semiconductor for SnS. Electrochemical results show that the passive film that formed in the hydroxide solution is more homogeneous than that formed in the sulfide solution. It was seen the differences is found concerning Efb and the second in the concentration of donors.
Keywords: SnS, Passivation, Electrochemical impedance spectroscopy, Semiconductor properties

Comparison of electrochemical behavior ofthe passive film formed on Niin different acid solutions.

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Abstract. Ni and its alloys have been employed as structural materials in corrosive environments because of their excellent corrosion resistance. The excellent corrosion resistance of this metallic material is largely due to the protective passive film formed on the surface [1,2]. This paper focuses on electrochemical studies of nickel oxide, formed on metallic Ni electrode in 1N $H_3PO_4$and 1N H_2SO_4 aqueous solutions by means of anodic polarization at various temperatures.Open circuit potential (ocp), potentiostatic polarization, potentiodynamic polarization, electrochemical impedance spectroscopyand capacitance measurements are the principal techniques which are used. Mott–Schottky analysis shows that the passive film formed on nickel is p-type, corresponding to a preponderance of oxygen vacancies and nickel interstitials in the barrier layer[3].The acceptor density and flat potential,of the semi-conductive passive layer growing on nickel surface in phosphoric acid and sulfuric acid solutions, were determined.
Keywords : Nickel oxide- Sulfuric acid- Mott-Shottky-Corrosion

Corrosion protection of electro-galvanised steel by ceria based conversion coatings, Influence of PEG Addition

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Abstract. A cerium oxide thin layer was deposited onto galvanized steel by cathodic electrodeposition, from 0.1 M concentrated cerium nitrate solution. In this work, the influence of polyethylene glycol (PEG) addition on the composition and morphology of the deposits is examined. The results showed that the addition of PEG to the cerium nitrate solutions lead to decrease the cracks in the deposits by decreasing the hydrogen reduction reaction and by decreasing the film thickness which provided enhanced corrosion protection. Moreover, the substrate dissolution reaction is inhibited.
Keywords: Electrodeposited coatings, Rare earth elements, Zinc, Polarization, EIS.

Inhibition of the corrosion of steel in .06M NaCl by Ethylene diamine tetraacetic acid (EDTA).

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Abstract. The inhibitive action of EDTA on steel corrosion in 0.6 M NaCl solution was studied using weight loss measurements, potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) techniques.The surface of the carbon steel samples was also analyzed by scanning electron microscopy (SEM) in the absence and presence of inhibitor. Polarization curves indicate that EDTA is a mixed-type inhibitor in 0.6M NaCl solution and the inhibition efficiency (IE%) is temperature-dependent. Adsorption of EDTA on the steel surface follows the Temkin isotherm model. The thermodynamic parameters of dissolution and adsorption processes are calculated from experimental polarization data and interpretation of the results are given.
The results showed that the adsorption of the EDTA is related to the concentration and strongly influenced by the temperature.
The thermodynamic study has shown that the adsorption process is spontaneous (negative free energy) and physical type. Keywords : Blends, Biopolymer, Poly(lactic acid), Polycarbonate, Thermal stability.
Key words: Corrosion; inhibition; EDTA ; Activation energy; Adsorption isotherms.

The effect of substrate bias voltage on the corrosion behavior of ZrO2 thin films deposited by radio-frequency magnetron sputtering for biomedical application

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Abstract. The aim of this paper is to study the influence of the substrate bias on the properties of ZrO2 thin films deposited for biomedical application. The ZrO2 films were grown onto 316L stainless steel substrate using radio-frequency (rf) magnetron sputtering from a pure zirconium target in Ar-O2 gas mixture. The substrate bias voltage was varied (0, -75V) which produced a variations of structure, electrochemical and mechanical properties of the films. The deposited films were characterized by X-Rays Diffraction, scanning electron microscopy and potentiodynamic polarization. Experimental results showed that the thickness for non-biased substrate is higher than the one for bias voltage from 1um to 0.75 um respectively. XRD results show that all structures of the films are crystalline and changed with varying the bias voltage. The monoclinic phase is predominant in unbias deposited films; however, the tetragonal phase integrates in the bias deposited films. The optimum anti-corrosion performance was obtained for ZrO2 deposited at a bias of-75 V.
Keywords: Biomaterial, ZrO_2 , magnetron spurting, DRX, Corrosion Introduction.

Microstructure study of anodic layers for biomedical application

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Abstract. Titanium electrochemical anodization has received much attention for their use in biomedical purposes, offering a biocompatible titanium oxide with large surface area architecture and highly controllable Nano-scale features. Here we studies TiO2 layer synthesized on well-polished and treated titanium surface by ano-dization technique under external voltage of 20 V for 15, 30 and 45 minutes respectively, using as specific electrolyte composed by: 1M CH3COOH / 1.5 wt% NaF / 2wt% Urea. The interfacial integrity and compositional variation along the interface were studied using Scanning Electronic Microscopy (SEM) with energy dispersive analysis of X-ray (EDX), the mechanical properties of TiO2 nanotube arrays were explored by a nanoindentation apparatus and the electrochemical behavior was investigated employing open circuit potential (OCP), electrochemical impedance spectroscopy (EIS) and linear polarization (LP) in Hank's solution as Physiological environment. Raman scattering and XRD were employed to investigation the evolution of the phase in the nanocrystal during annealing. The SEM characterization reveals interesting uniform and vertically-aligned TiO2 Nano-tubes arrays made-up on titanium substrates, with no significant effect of anodization duration on the tube diameter of 80 nm approximately. On the other hand, both EIS and LP measurements show a clear improvement in behavior against corrosion.

The influence of substrate bias voltage on the electromechanical propertie of ZrN thin films deposited by radio-frequency magnetron sputtering: biomedical application.

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Abstract. In order to study the influence of the substrate bias on the properties of ZrN thin films deposited by radio-frequency magnetron spurting for biomedical application; Films of ZrN were grown onto 316L stainless steel substrate using radio-frequency (rf) magnetron sputtering from a pure zirconium target in Ar-N_2 gas mixture. The substrate bias voltage were varied from 0 to -100 V, which produces a variations in the structural, electrochemical and properties of the obtained films. The deposited films were characterized by X-Rays Diffraction, Atomic Force Microscopy, scanning force microscopy and potentiodynamic polarization.
Keywords : Biomaterials, 316L stainless steel, ZrN, RF magnetron spurting, Bias voltage, XRD, AFM, corrosion propertie.

Corrosion performance of TiO_2 coatings coated on 316 stainless steel in 3.5% NaCl solution at room temperature

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Abstract. One of the most useful methods to protect stainless steel from corrosion is to coat the steel surface with a protective coating such as titanium carbide (TiC), titanium carbonitride (TiCN) and titanium dioxide (TiO_2). A series of TiO_2 coatings was deposited onto stainless steel substrates by magnetron sputtering (13.56 MHz) of a titanium target using Ar/O_2 reactive mixtures over a broad range of total sputtering pressures from 15 mTorr to 30 mTorr. The effect of bias voltage, the pressure and the oxygen partial pressure on the electrochemical corrosion behaviors was investigated. The corrosion protections of the coatings were studied by the electrochemical measurements in the NaCl solution (3.5%). Corrosion potentials (Ecorr) and the corrosion current densities (icorr) were calculated by using instantaneous Tafel-type fit Versa Studio corrosion analysis software. Finally, the electrochemical measurements show that the TiO_2 coatings significantly decrease the corrosion currents densities (icorr), as simultaneously increased the values of polarization resistance (Rp) of stainless steel. It indicates the TiO_2 coatings exhibit excellent anticorrosion properties in in 3.5% NaCl solution at the room temperature.
Keywords : TiO_2;Corrosion behavior; Stainless steel;coatings; magnetron sputtering.

The effect of sulfuric anodization of AA6061 Alloy on the mechanical behaviour

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Abstract. The 6061 aluminium alloy is a very important structural material in nuclear research reactors. This alloy spontaneously builds up a few manometers thick layer of alumina in presence of oxygen. In order to increase this layer an anodizing process is necessary. The morphology of the oxide layer and the surface properties are directly related to the nature of the base alloy and the anodizing parameters. This modification will result in a modification of the mechanical behaviour.
Keywords: AA6061, Oxide layer, Anodizing, Mechanical behaviour

Corrosion Behaviors of Heat Treated carbon steel in alkaline media

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Abstract. Corrosion of X52 steel with different heat treatments (normalizing, annealing, quenching and tempering) in an alkaline soil was investigated by electrochemical measurements included potenthiodynamic polarization curves, and linear polarization resistance (LPR) measurements. As a result, The Corrosion of steel is affected by its microstructure. Generally, steels with heat treatments have a higher corrosion rate than the as-received steel. The presence of more pearlite enhances the corrosion rate of ferrite by a galvanic effect. When the steel contains martensite phases, the activity of the carbon steel is further increased.
Keywords : carbon steel; corrosion; heat treatments, electrochemical measurements; alkaline media.

Sn_xS_y thin films deposition by spray pyrolysis atdifferent deposition time

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Abstract. Sn_xS_y thin films were prepared by spray ultrasonic technique on glass substrate at different experimental conditions, using two precursors namely: tin (II) chloride and tin (IV) chloride, respectively. The present work focuses on the influence of the deposition time for two precursors on the nature and the properties of the prepared thin films in order to optimize the growth conditions. X-ray diffraction analysis revealed that the precursors alter the nanocrystalline nature of the prepared films and crystallites size varied from 11.20 to 19.36 nm and from 12.86 to 40.50 nm, according to the used precursor. The results of (UV) spectroscopy visible spectrum show that films deposited at 10 min are high absorbance in the visible region for two precursors .Electrical measurements indicate that the resistivity behavior depends on the used precursors and deposition time.
Keywords : Tin sulfide; Ultrasonic spray; Thin films; Precursors.

Synthesis and study of the optical properties of thin layers of titanium dioxide Using DC Magnetron sputtering technology

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Abstract. Titanium dioxide (TiO_2) generally exists in three crystallographic phases: anatase, rutile and brookite. In this study, we discussed the synthesis and the study of the optical properties of TiO_2 thin film deposited by DC magnetron sputtering technology on glass substrates under different experimental conditions. The objective is to follow the evolution and formation of TiO_2 thin films for applications in the field of gas sensors. For optical analysis, the samples were analyzed by UV-visible spectrophotometry.
Keywords: TiO2; band gap; Optical propertiest.

Synthesis and characterization of Nickel oxide (NiO) thin films

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Abstract. For the synthesis of Nickel oxide as thin films, with the spray pyrolysis technical as a chemical method of deposit, on ordinary glass substrates heated to a fixed temperature of 500 ° C. we use Nickel nitrate hexahydrate (99.5 %, Aldrich) as source precursor, dissolved in distilled water.
Nickel oxide is ap-type semiconductor, is an important material because of its large direct optical gapbetween 3.6 and 4.0eV, and easy to deposit in thin layers by many techniques, such as sol-gel and spray pyrolysis.

Diagrams of X-ray diffraction (XRD), to confirm the formation of the phase have characterized the structure of the films deposited by the pyrolysis spray technique. Where they showed that NiO are nanoparticle films and have preferred orientations according to (111) and grain sizes in the range of 15 to 48 nm.
the surface morphology, absorption domain, molecular vibrations were characterized by scanning electron microscopy (SEM), UV-Visible Spectroscopy and Ramanspectroscopy.
Keywords: Spray, NiO, Optical Properties, UV-Visible Spectroscopy, XDR.

Effect of the solvent on the proprieties of copper oxide (CuO) thin films deposited by spray pyrolysis

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Abstract.This This work is a comparative study between the effect of H_2O and methanol solvents on microstructure, optical and morphological properties of CuO films. CuO films were deposited by the spray pyrolysis method on low price glass at 500°C. Copper nitrate trihydrate has been used as a precursor of cupric oxide dissolved in different solvents (H_2O, methanol) with concentration 0.1M. CuO thin films were characterized by using X-ray diffraction (XRD), scanning electron microscopy (SEM) coupled with (EDX) and spectrophotometer UV-Vis. The XRD technique showed two characteristics peak (diffraction plans) (111), (-111) observed on all the elaborated samples that confirms the presence of the CuO monocrystalline phase. The morphological of surface samples analyzed using the scanning electron microscope (SEM) indicates the uniformity of the CuO thin films with a periodic stack atoms having crystallographic planes of minimum surface energy density. the CuO thin films (methanol) are more porous than CuO thin films (H_2O).
Keywords: component; Thin films; solvent; cuprous oxide; spray pyrolysis; SEM; XRD.

Charpy Impact and Pitting Corrosion Resistance of AISI 316L Welded Joints in 3,5% NaCl

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Abstract .This work aims to determine the charpy impact thoghness and pitting corrosion resistance of AISI316L welded joints. Austenitic stainless steel 316Lwas welded using gas tungsten arc welding process (GTAW). The Filling up of the but joint was done in three passes using separately tow filler metals: ER316LN and ER308LN. Welding has a significant influence on microstructural evolution of 316L austenitic stainless steel. The welded joint (316L/ER308LN) absorbs the highest energy without being broken during the impact charpy test. The advance of the crack in the fusion zone of (316L/ER308LN) welded joint is less easy compared to that in the fusion zone of (316L/ER316LN) welded joint. Corrosion resistance of the welded joints in 3,5 % NaCl solution at room temperature was evaluated using potentiodynamic polarization. The Results obtained have shown that the weld metal obtained with ER308LN as a filler metal enhances the its pitting corrosion due to high chromium content.
Keywords: AISI 316L, filler metal, weld metal, charpy impact toughness, pitting corrosion resistance.

Evaluation of Organic inhibitor efficiency on the ordinary steel in saline medium

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Abstract. This work describes the study of the performances of an organic compound. This work describes the comparative study of the inhibitor effect of two organic molecules which are: Ketamine®F3100 and Ferrofos®8549. These two inhibitors were tested as a corrosion inhibitor on carbon steel (X70) in saline medium. The results obtained allowed us mainly to evaluate the inhibitory effectiveness of this organic compound via steel, as well as its environmental environment. Electrochemical analysis on the corrosion of X70 steel, show that Ketamine® has no inhibitory effect on steel while Ferrofos has shown a very significant inhibitory efficiency (E (%) = 99.7%) vis-a-vis the test metal.
Keywords: Inhibition, Organic inhibitor, Electrochemical analyze, Corrosion, Steel.

Significant efficiency of Ketamine® as corrosion inhibitor for X70 steel

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Abstract. This work describes the study of the performances of an organic compound, (R,S)-2- (2-chlorophenyl) -2-methylamino-cyclohexan-1-one, also known under the trade name Ketamine®. The latter tested as a corrosion inhibitor on carbon steel (X70). The results obtained allowed us mainly to evaluate the inhibitory effectiveness of this organic compound via steel, as well as its environmental environment. A positive significant effect of the inhibitor was observed in the reaction media with a less aggressively.
Keywords: Inhibition, Organic Molecule, Impedance, Corrosion, Steel, Ketamine®.

Corrosion of AISI4130 in différents électrolytiques solution

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Abstract. This article discusses the electrochemical behavior of AISI 4130 alloy steel in various electrolyte solutions H2SO4, HCl and NaCl. Corrosion tests were carried out on a potentiostat / galvanostatat room temperature in the various electrolytes, under an Ag / AgCl reference electrode with .Electrochemical Impedance Spectroscopy (EIS) measurement. The results obtained through the tafel curves show that the corrosion process can be divided in two parts highlighting the aggressivity of Cl- ions. The impedance which is characterized by a large semicircle in the Nyquist graph increases under H2SO4.Equivalent circuits have been determined to represent the corrosion processes at differente ectrolytes.
Keywords: AISI 4130, corrosion; H2SO4, HCl and NaCl

Topic 4

Non-destructive Evaluation of Material: Modelling and Data Processing, High-Resolution NDT, New NDT Methods.

VARIATION OF EFFECTIVE PERMITTIVITY AS A FUNCTION OF FREQUENCY FOR CONCENTRATION IN AIR DONNEE AND FOR A REPORT E/C MAKES.

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Abstract. Two types of material characterization tests are known: Destructive tests and non-destructive tests. In this work, we will try to approach this characterization by a nondestructive test. It consists in the use of a dielectric characteristic of the material to follow the variation of its resistance through its porosity. . The electrical characteristic used is the dielectric permittivity. The material concerned by this study is the cement mortar.
Keywords: Non Destructive Testing, Resistance, Dielectric Permittivity, Porosity, Cement Mortar.

Thermal behavior of electrical properties of DBSA doped Pani composites: An experimental study

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Abstract. Conducting powder of polystyrene/polyaniline (PS/PANI) was prepared by chemical polymerization of aniline using the 4-Dodecylbenzenesulfonic acid (DBSA) as a dopant and ammonium persulfate (APS) as an oxidizer in presence of polystyrene. The AC conductivity measurements were investigated in the frequency range of 10^{-1} - 10^{6} Hz by a Novocontrol broadband dielectric spectrometer. The synthesized powder combines the mechanical properties of PS and the electrical properties of PANI. The frequency dependence of AC conductivity obeys the Jonscher's universal power law for Ps/PANI pellets. The temperature dependence of the conductivity is found to obey an Arrhenius law with activation energy of 0.1 ev which support that electronic hopping conduction mechanism. The higher dielectric constant of the PS/PANI samples indicates their better ability to store the electric potential when subjected to an alternating field.
Keywords : polyaniline; polystyrene; composite; DBSA; dielectric constant; conductivity.

Non-destructive characterization of metallic structures by using of Rayleigh waves

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Abstract. In this study, the properties of the Rayleigh surface waves have been first discussed. A simple technique using longitudinal waves transducers coupled to a comb-like structureconceived for the generation and the detection of Rayleighwaves in an aluminum material was used. The propagation speed and the attenuation of this type of waves were determined with a very good precision. Afterward, this experimental device was used to determine the depth of cracks at the surface of this material. The values of the smaller depths less than twice the wavelength of the Rayleigh wave have beenobtained with a satisfactory precision. The results of the achieved measurements are in good agreement with the theoretical predictions. Benefiting ofits simplicity, this experimental device can be used to establish abacuses with the aim of a better characterizing of surface cracks in materials used in the industrial domain such as railroadsrails.
Keywords: NDT, ultrasonic propagation, Rayleigh waves, crack depth, propagation velocity and attenuation.

Comparison of Conventional and Novel Eddy Current Probes

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Abstract. New probe technology makes flexible arrays easier and cheaper to use, and eddy current systems and software easier to apply to new testing requirements, and simple enough for entry level technicians to learn and operate. The outcome is better, more uniform test with a digital record. And since the eddy current arrays are tunable to a particular defect type or size, the Probability of Detection increases dramatically for the defects of interest compared to manual single channel eddy current inspection. IN this paper, we designed Eddy Current probes based on two different technologies, depending on the application. The first one is based on traditional probes based on classical winding coils, the second one takes advantage of the small size and high sensitivity of micro-coils etched on a flexible kapton film. The simulation also provides the ability to compare upstream performance of a new probe relative to a conventional sensor.
Keywords: Eddy current; Defect characterization; NDT; Finite element method; Micro coil; Flexible array probe.

Estimation of the concrete durability by Non Destructive Testing (ultrasonic pulse velocity)

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Abstract. This study concerned the influence of concrete compositions on the propagation of ultrasonic waves as well as its relationship with some concrete properties affecting its durability (compressive strength, water-accessible porosity and water permeability). Specimens of different concrete formulations, differentiated by the cement dosage and the water/cement ratio (W/C) were tested. The results highlight the influence of the composition of concretes (W/C ratio and cement dosage) on ultrasonic pulse velocities UPV. The increase in cement content and decreasing the W/C ratio increases the velocity of the ultrasonic waves. Compression strength is changing exponentially with UPV. The increase in the accessible porosity Pwater and the permeability to water DPW of the concretes have a negative influence on the ultrasonic waves. These velocities are well correlated with W/C ratios and strengths. While with porosities and permeabilities, they are only for compositions of the same cement dosage.
Keywords: Concretes; ultrasonic velocities; strength; porosity; permeability.

Contribution of the acoustic emission for the evaluation of the damage of the concrete material

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Abstract. Concrete is vulnerable to actions that generate tractions in the elements that favor the appearance of different types of cracks. The cracking phenomenon of concrete is quite complex. For hardened concrete, the causes of cracking are many and varied: physico-chemical, thermal, and mechanical. In the present study we interested to the monitoring and evaluation of mechanical concrete cracking by using the acoustic emission technique. Notched three-point bend specimens were tested under crack mouth opening displacement. The acoustic emission (AE) technique was applied to monitor crack growth and characterize the crack development

during bending tests. The cumulative location of the acoustic events and the physical parameters of the signals (hits, events, energy) during the different phases of the bending test were studied.
Keywords : Acoustic emission, concrete, bending test, cracking, energy, event.

Non destructive test for optical components by analysing wavefront distortions in the imaging system using interferometry.

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Abstract: Several damages were found on remediation networks (pipes and manholes) in Ouargla -Algeria, due a to product quality of concrete and aggressive external environment. The objective of this work is to study the sustainability of pipes for sanitation networks in this region under the effect of sulfates attack (especially H_2S). To do this, Sulphate resisting cement (SRC) specimens have been preserved in the real world and the results were compared with those of control specimens. According to the study, we concluded that the cement concrete SRC submitted acceptable mechanical properties in wastewater compared to concrete witnesses and penetration of aggressive agents rather slow, where a small decline in mechanical compressive strength from 3% to the duration of 365 days of storage. But the exposure of cement concrete SRC to H_2S gas, shows a degradation accelerated concrete under the effect of H_2S gas in particular after 90 days of age, when a 40% regression of approximately compressive strength compared witnesses specimens at the age of 365 days.
Keywords : Durability, sulphate resisting cement (SRC), sanitation, waste water, H2S gas.

Experimental and numerical study of low velocity impact response of GFRP structure

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Abstract. Composite materials are widely used in load carrying applications because of their specific properties like strength, stiffness and design flexibility. Low velocity impact is considered as one of the most detrimental solicitation for composite laminates, resulting in significant internal damages that are difficult to detect through routine inspections and alter drastically the mechanical properties. The present work describes a contribution to experimental and numerical investigations of impact-induced damage of Glass Fiber Reinforced Polymer (GFRP) composite subjected to low velocity impact. In this study, a drop weight tour was used to conduct low velocity impact tests where force-time characteristic curves were plotted using dynamic force sensor. A linear correlation between the impact force and impact energy was found and thus producing more damage. Damage evolution was then inspected visually and using ultrasonic b-scan and c-scan technics. C-scan inspections showed that the impact led to diamond-shaped damage resulting from different failure mechanisms: fibre breakages in warp and weft directions, more or less inter-laminar and intra-ply damage. Impact events were modelled using an explicit finite element (FE) code. Results showed a good correlation with experimental tests, demonstrating that the physics behind the real impact damage is well accounted for in the numerical simulation. In addition, Compression After Impact (CAI) tests were conducted on a conventional testing machine to assess residual strength on structures containing barely visible impact damage. Stress-strain and load-strain curves were plotted. Samples impacted at higher energies failed much rapidly than others. Delamination constitutes a severe discontinuity and can cause rapid and catastrophic buckling failure. Since the studied composite laminates is prone to delamination when impacted, damage tolerance evaluation of the structure is carried out to ensure that no serious accidental damage might occur within the operational life of the airplane and the remaining structure can withstand reasonable loads without failure or excessive structural damages.
Keywords:Low impact speed, CAI, GFRP, damage, NDT, Finite element modelling.

Theoretical study of the reflection at a liquid solid interface of a transient ultrasonic field radiated by a linear phased array transducer

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Abstract. We have used a model for the study of the transient ultrasonic waves radiated by a linear phased array transducer in a liquid then reflected at a liquid solid interface. This model is based on the Rayleigh integral where the reflection at the plane interface is taken into account by using the reflection coefficients for harmonic plane waves. The transient field is obtained by an inverse Fourier transform of the harmonic results.The results obtained highlighted the different components of the ultrasonic field : the direct and edge waves as well as the longitudinal head waves or leaky Rayleigh waves. The transient representation of these waves have been analysed and discussed by the rays model. Instantaneous cartographies allowed a clear description of all the waves which appear at the liquid-solid interface.
The obtained results have been compared to those obtained by using a finite element method package.
Keywords : Rayleigh integral method; Liquid solid interface; Linear phased arrays transducer; Pulsed ultrasonic.

What are the bridge in Algeria suffering and how to test by CND? Case study

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Abstract. In civil engineering, the most famous culture is the quality where it is necessary to know how, to know how to be and to know how to protect the works so that they play their part in the most favorable conditions. Good design with good performance is a crucial step to avoid such degradations over time. Also, permanent monitoring using NDT non-destructive testing tools to assess the quality of materials is mandatory in order to know the degree of progress of the disorders and thus facilitate the protection of the structures. The objective of this work is to evaluate the quality of the concrete material of the various engineering structures located in the North-East of Algeria using the non-destructive methods CND (sonic auscultation and sclerometer).
Keywords: Art work; concrete material; design defects; CND.

Numerical analysis of eddy current distribution in laminated CFRP materials

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Abstract. This paper presents a numerical analysis of the eddy current distribution developed in carbon fibre reinforced polymer (CFRP) laminates for different anisotropic ratios. This investigation aims to orient the research on the eddy currents non-destructive testing problems of composite materials. The finite volume method (FVM) is used to develop a 3D model based on the A-V formulation. The developed model is based on the hexahedral mesh. What's more, this model takes into account the influence of different orientations of the fibres on the electromagnetic parameters.
Keywords: Composite materials, 3D-FVM method, EC-NDT.

Performance of some Variational Implicit Deformable Models on Segmenting Optical Microscopy Images

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Abstract. Industrial micrographs are used to evaluate a steels or alloys. This assessment consists of visualizing and describing the basic element (at the nanoscale) constituting the material. The information provided by the micrographic images need to be highlighted by image processing methods. In this paper the performance of some region-based variational models are presented. Such study allows to choose best models that give the more accuracy segmentation in less processing time.
Keywords : Material microstructures, Microscopy images,Segmentation, deformable models, region-based active contours.

Video Processing Software-based Pipeline Endoscopic Inspection

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Abstract. Currently, all the codes and the standards of the fluids transport industries require rigorous pipeline inspection, in order to detect all defects and anomalies and avoid leaks and failures. For this reason, a team within the division of Signal Processing and Imagery had as mission to develop an endoscope which can replace the operator inspection inside the pipeline and improve its quality and diagnostic. This endoscope named 'Pipe Explorer' is controlled by FPGA microcontrollers, and is equipped with a camera. While moving inside the pipe, the camera records a video on the memory card. In this way and in order to offer a practical tool to the operator, we have developed graphical software based on processing techniques of the stored video consisting in video preprocessing and segmentation. At the end of this processing, we obtain a video result on which appears the analysis and the interpretation of the original video to give an internal pipe quality diagnosis. The results shows all the defective areas such as corrosion which are stained with {green, blue, red} color according to its degree of severity and the risk of harmfulness on the inspected pipeline.
Keywords: Pipeline inspection, endoscopy, video processing, video segmentation, corrosion.

Study and modelling of a microwave sensor to characterize a dielectric materials and for CND applications

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Abstract.Non-destructive testing is a science of evaluation various properties of materials, without compromising its usefulness and use. These properties can be physical, chemical, mechanical or geometrical. There are several techniques of non-destructive testing such as: acoustic emission, penetrate testing, eddy current, ultrasound and radiography, ... However, each of these methods has certain limitations and disadvantages. Since the 1970s, some researchers have tried to use microwave techniques to detect possible surface cracks in metal components, volumic cracks in dielectric materials or to characterize a dielectric material.
The objective of this article is to present a method of characterization of dielectric materials, by modeling a microwave sensor. A change in the resonant frequency of the microwave sensor resulting from a change in its effective dielectric constant is considered as an index to define the dielectric constant of the sample. This work was devoted to study, modelling and realization of a micro strip structure by the method of moments, later this structure will be simulated by a numerical modelling software HFSS (High-Frequency Structure Simulator) to confirm the results and validate the model.

Keywords: Non-Destructive Testing; Microwave Techniques; HFSS; Microwave Sensor; Dielectric Constant; Micro strip Modelling; Moment Method.

Images Segmentation with Rayleigh and Gaussian Mixture Model (RMM & GMM)

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Abstract. Image segmentation is an important research field in artificial vision. It is the partition process of a digital image into parts that are meaningful with regards to the involved application. Some of these process outcomes are homogeneous or textured regions while others consists of boundaries separating objects of interest. Hence, it is the transformation of a complex image to something which is easier to analyze by the next higher analysis stages. This paper aims at developing segmentation methods by using probabilistic laws mixture. We explore here the utilization of Gaussian and Rayleigh mixtures models in histogram classification-based image segmentation. Tests were applied for the segmentation of synthetic images where the obtained results are revealed to be satisfactory.
Keywords: Image segmentation, Mixture models, Gaussian distribution, Rayleigh distribution.

Design of Sobel Filter in VHDL

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Abstract. In order to automate the quality control process of pipe's welding joint, we present in this paper a new design of an embedded computer vision system, which is based on a camera, controlled by an FPGA platform (Zynq-7000) for acquisition and image processing on the same FPGA circuit. A VHDL implementation of Sobel Edge Detection Algorithm is proposed. The obtained results were validated with those obtained by MATLAB. This will allow us to develop other tools more powerful and more robust.
Keywords : Quality control; pipe welds; FPGA; Sobel; VHDL; Zynq-7000.