Editorial for Special Issue ‘’Nanotechnology Engineering’’

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Abstract−This Editorial paper presents the special issue of the ENP Engineering Science Journal special issue on ‘’Nanotechnology Engineering’’.

***Keywords*− Nanotechnology, Engineering.**

This special issue presents extended versions of papers selected from the First Symposium of the Algerian Academy of Sciences and Technologies (AAST) on Nanotechnologies that had place on June 26 and 27, 2022 at the M'hamed Bougara University, Boumerdes. Eight papers are accepted after following the ENPESJ review process.

In the article “Magnetic properties and Structural characterization of nanocrystalline Fe-20%A (Ni, Co and Si) alloys powders synthesized by mechanical alloying process” [1] Abderrahmane Younes et al. deal with the preparation and characterization of nanocrystalline Fe-A (Ni, Co, and Si) alloy powders using mechanical alloying technique with Retsch PM 400 high energy planetary ball mill. The evolution of the phases and magnetic properties of the powders are investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray (EDX), and vibrating sample magnetometer (VSM) as a function of grinding time. The XRD results indicate that after 20 hours of milling, the FeNi, FeCo, and FeSi phases are completely formed. The lattice deformation of FeSi alloy is 0.7%, and the grain size decreased to 17 nm, 13.5 nm, and 10 nm for FeNi, FeCo, and FeSi, respectively. The VSM results show that the magnetic properties of FeNi, FeCo, and FeSi alloy nanoparticles are influenced by the composition, size, and morphology of the particles.

In the article “Hybrid materials based on Fe2O3/metal-oxide reinforced polyaniline: Synthesis, characterization and their electrochemical properties’’ [2] Fatima Zohra Zeggai et al. develop Polyaniline (PANI)-Fe2O3/CuO and PANI - Fe2O3/ZnO hybrid materials in situ polymerization at 0°C using ammonium persulfate as oxidant. The resulting products are investigated for their structural properties by X-ray diffraction (XRD), Fourier transform infrared (FTIR), and scanning electron microscopy (SEM), and the results confirm the formation of the hybrid architecture. In addition, the electrochemical properties of the hybrid products are investigated by cyclic voltammetry (CV) and optical properties are determined using UV-Vis Diffuse Reflectance Spectrophotometer (UV-Vis DRS). Compared to PANI/ZnO or CuO, Fe2O3/CuO or ZnO exhibit significantly improved properties. Based on the obtained results, the products thus open the way for a variety of electrical and sensors applications.

In the article “Behavior of Materials in the Presence of Particles Additive Technique: A Review’’ [3] Fares Mohammed Laid Rekbi reviews the salient features of experimental as well as numerical investigation on characteristics composite materials with adding either micro- or nano-particles, which is one of the ways to express it. The behavior of composites materials such as mechanical enhanced with different form, size, type and nature of particle additives. The bibliography review concludes that it would be important to investigate extensively the features of the aforementioned technique in order to get more discoveries and developments of materials experimentally and numerically. Some contributions have identified the research gaps and deduced that the potential application of particles as additive agents in composites have not been more explored.

In the article “Electrochemical Measurements of Ni / Graphene based Nanohybrids for Electrochemical Energy Storage (Supercapacitors)’’ [4] Ikram Djebablia et al. deal with the application of new smart nanomaterials for supercapacitors and biosensors has become a vital issue for human and industrial societies. The authors have produced electroactive nanohybrids based on in-situ Ni mono-hydroxide few layers Graphene oxide "GO" using a simple and low cost hydrothermal technique under well-studied thermodynamic conditions (120 and 180 °C growth temperature), for performant supercapacitor devices. They have carried out various electrochemical measurements through Cyclic Voltammetry tests and have marked the important electrochemical properties of these Ni/Graphene nanohybrids in two NaOH electrolyte concentrations (0.1 and 1 M) in order to improve the performance of supercapacitors which have become a socio-economic issue with this nanotechnological development.

In the article “Physico-Chemical Properties of Three Synthesized Carbonaceous Nanomaterials (CNTs, GO, Biochar) for Perspective Application: Water / Soil Treatment and Energy Storage’’ [5] Hanene Araissia et al. report a comparison of three kinds of nanostructured carbon based smart nanomaterials synthesized at different dimension (1D, 2D and 3D) using physico-chemical growth processes. The obtained nanostructured carbon have shown structural forms in the case of MWNTs and graphene type having 1D and 2D configuration, respectively, as well as an amorphous form in the case of biochar having 3D porous configuration which contains less cohesive bonds than graphene and MWNTs. The two structured ones have shown interesting characteristics of their specific surface area in the range 150-2400 m2/g and functional groups; which open up a wide field of application especially environmental protection and biosensing.

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In the article "Goethite Nanofibers /CNTs based Nanocomposites Synthesized by Free-Template Hydrothermal Method and their Physico-Chemical Properties for Energy Storage Application'' [6] Sara Djelamda et al. report the synthesis of Goethite-NFs/CNTs nanocomposites using hydrothermal method at optimized growth condition. The obtained Goethite nanofibers (NFs) have shown structured triangular base nanofibers with diameter in the range [181 - 363 nm]. Using nested and twisted CNTs (MWNTs type) but fairly homogeneous in diameter around 48 nm, the formation of an assembly of two forms (MWNTs and iron oxide Nanofibers) in nanocomposite configuration confirms the significant improvement of their physico-chemical properties, like the increase in their electrical conductivity proven by their obtained gap energy Eg from 3.12 to 2.50 eV. Consequently, the reached results prove that this kind of iron oxide-NFs/MWNTs based nanocomposites can be excellent candidate as electroactive nanomaterials for energy storage application.

In the article "Optoelectronic and Thermoelectric Properties of the Tetragonal Structure of the Halide Perovskite Material RbSeBr3 used for low-cost Photovoltaic'' [7] Rabah Mehyaoui et al. investigate the Perovskite solar cells. The structural, electronic and optical properties of the tetragonal inorganic halideperovskiteRbSeBr3 are performed using the full potential linearized augmented plane waves (FP-LAPW) method with the PerdewBurke–Ernzerh generalized gradient approximation (PBE-GGA) as well as the local density approximation (LDA) and the modified Becke-Johnson (mBJ-LDA) as exchange correlation potentials using Wien2k code. The thermoelectric properties have been calculated using BoltzTrap code, the obtained results show that the studied compound (RbSeBr3) has a metallic character and can be used as an absorber in UV-interval.

In the article "Catalytic pyrolysis of high-density polyethylene for the production of carbon nanomaterials: effect of pyrolysis temperature'' [8] Salma Belbessai et al. have considered a two-stage reaction process for converting high-density polyethylene (HDPE) into carbon nanofilaments (CNFs) and hydrogen-rich gas. The experiments are performed in a continuous mode in a two-stage quartz reactor: thermal pyrolysis of HDPE followed by the catalytic decomposition of the pyrolysis gases over a nickel catalyst prepared from mining residues.The results showed that the production of carbon nanomaterials (CNMs) and H2 is optimal at 650 °C, with yields of 70.8 and 38.0 wt%, respectively. Scanning electron microscopy (SEM) revealed the presence of carbon filaments with different diameters and lengths at the three different temperatures. The thermogravimetric analysis (TGA) confirmed that the produced carbon is filamentous, with the presence of amorphous carbon at 700 °C.

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Azzedine Bousseksou received a diploma in Material Physics from the Bab Ezzouar University (Algiers). He also received a DEA in Materials Science from the University of Nantes in 1988 and then obtained a PhD in Materials Science from the Pierre and Marie Curie University in Paris in 1992. He began his career at the CNRS Coordination Chemistry Laboratory in Toulouse as a research fellow in 1993. In January 2003, while in charge of Research at the LCC-CNRS Toulouse, he created and directed the scientific team "Switchable Molecular Materials". Between 2011 and 2013, he was Deputy Director of the LCC-CNRS Toulouse and has been Director since 2013. He has supervised about twenty post-doctoral students and more than thirty theses. He has registered 16 patents, 2 of which are being exploited, and one Startup in incubation. He published over 380 articles with h-index (2023) ~71. He is a member of 4 academies: the French Academy of Sciences (2013), founding member of the Algerian Academy of Science and Technology -AAST- (2015), member of the European Academy of Sciences and arts (2012) and member of the European Academy of sciences (2014). He received several Award such as Prestigious Süe Prize of the French Society of Chemistry, 2020 Korean Magnetic Society Award, 2012 Prix la Recherche, Chemistry section, 2011 Langevin Prize of the French Academy of Sciences (FR), 2009 SCF Co-ordination Chemistry Division Award, 2003.

Jean-Pierre Sauvage, 2016 Nobel Prize in Chemistry, earned his PhD degree from Louis-Pasteur University under the supervision of Jean-Marie Lehn, himself a 1987 laureate of the Nobel Prize in Chemistry. During his doctoral work, he contributed to the first syntheses of the cryptand ligands. After postdoctoral research with Malcolm L. H. Green, he returned to Strasbourg, where he is now emeritus professor. Sauvage's scientific work has focused on creating molecules that mimic the functions of machines by changing their conformation in response to an external signal. He was elected a correspondent member of the French Academy of Sciences on 26 March 1990, and became a member on 24 November 1997. He is currently emeritus professor at the University of Strasbourg (Unistra). He shared the 2016 Nobel Prize in Chemistry "for the design and synthesis of molecular machines" with Sir J. Fraser Stoddart and Bernard L. Feringa. He was elected a foreign associate of the US National Academy of Sciences in April 2019. As of 2021, Sauvage has an h-index of 109 according to Google Scholar and of 100 according to Scopus