31ST MATERIALS SCIENCE AND ENGINEERING CONFERENCE: ADVANCEMENT & INNOVATIONS

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Posters

Arménio C Serra et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Compatibilization of polypropylene and recycled polyethylene terephthalate blends with methacrylate glycidyl based copolymers

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Polyethylene Terephthalate (PET) is a very versatile polymer mainly used in the manufacture of bottles for water. Due to its rigidity, oxygen barrier effect and thermal stability PET can improve the mechanical and thermal properties of other common polymers (polyolefins), if efficiently blended. Also, recycled PET is available in the market large amounts. Polypropylene (PP) is one of the major polyolefins produced worldwide used in a variety or articles from packaging to fibers. With relative low price, its uses could be expanded if some modifications of its mechanical properties are achieved. One of the possibilities is the use of blends with polymers or particles that could improve the PP mechanic weaknesses. The major difficulty to surpass is the compatibilization process between the immiscible and polar polyester and the apolar polyethylene. In order to improve blending process two major strategies to create covalent bonds between the two polymers were described by using PP grafted glycidyl methacrylate or maleic anhydride grafted PP. These are the routes followed by the commercial compatibilizers. In this work, we synthesized copolymers containing different amounts glycidyl methacrylate and ethyl-hexyl acrylate and evaluate the effect of these copolymers on the compatibilization of polypropylene and recycled PET. The effect of the synthesized copolymers in the mechanical and thermal properties of the blends will be discussed.

Biography

Arménio C Serra has completed his study in Biochemistry from the University of Coimbra and has completed his Doctorate in Organic Chemistry. His research area includes sulfonyl radical reactions, synthesis of porphyrin macrocycles as photooxidation catalyst, photodynamic therapy, supported organic catalysts for carbon-carbon condensation reactions and carbon dioxide activation. Presently, he is the Professor of the Engineering Chemical Department in Coimbra University. His research topics are centered on the study of polymerization processes and in the use of biomolecules in material science.

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Synthesis of new-type Ag meso-particles for ultrasensitive SERS activity

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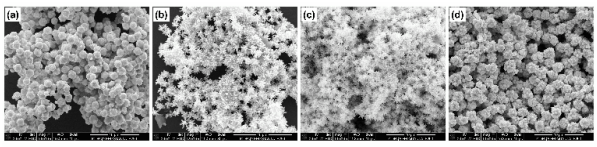

Figure 1. Various Ag-MPs morphologies: (a) polyhedron, (b) urchin-like, (c) multi-branched, and (d) meatball-like.

Surface-Enhanced Raman Scattering (SERS) spectroscopy is one of a few techniques that are capable of ultimately detecting matter at single molecule scale. The SERS activity of Noble-Metal Nano-Particles (NM-NPs) depends mainly on their shapes, as this determines the number and position of hot spots and, therefore, it is critical to have a purposeful control over the shapes in order to maximize their performance. Herein, using the control variate technique in the solution reaction process, various high-symmetrical Ag Meso-Particles (Ag-MPs) with well-tuned morphology were prepared for ultrasensitive SERS activity, which include polyhedron, urchin-like, multi-branched and meatball-like. Multi-branched Ag-MPs were shown to have the strongest SERS sensitivity in rhodamine B (RhB) detection in all samples as particle-array substrates with a detection limit of 10-13 M and an enhancement factor greater than 108, which can be undoubtedly applied to the molecular trace-detection. In order to verify the practical effectiveness, these Ag-MPs were used as the SERS materials for the in situ detection of a widely used growth regulator (forchlorfenuron) on an apple surface, showing clear Raman peaks at 0.01 ppm. Moreover, we investigated the influence of different variates on the morphology of Ag-MPs and propose a complete growth mechanism for these various Ag-MPs. This can provide a promising synthetic method to produce artistic Ag-architectures for SERS activity with ultrahigh sensitivity, good uniformity and low cost.

Biography

Hengwei Qiu has completed his Master's degree from Shandong Normal University in 2016. He is now studying for a PhD degree in Electronic Materials Research Laboratory, Key Laboratory of the Ministry of Education and International Center for Dielectric Research, Shaanxi Engineering Research Center of Advanced Energy Materials and Devices, Xi'an Jiaotong University. His research interests are design and synthesis of noble-metal nanostructures and their applications, especially for biosensors.

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Optimize the performance of graphene-based resistive random access memory device with the effective decoration of MoS_2

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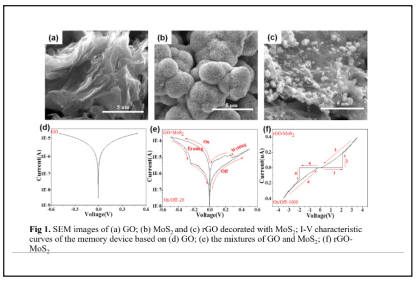

Fig 1. SEM images of (a) GO; (b) MoS_2 and (c) rGO decorated with MoS_2; I-V characteristic curves of the memory device based on (d) GO; (e) the mixtures of GO and MoS_2; (f) rGO-MoS_2

Graphene and its derivatives are widely used in Resistive Random Access Memory (RRAM) for their outstanding electrical properties. Considering the simplicity and economy of preparation method, Graphene Oxide (GO) and reduced Graphene Oxide (rGO) have attracted much more attention than graphene obtained by Chemical Vapor Deposition (CVD). However, suffering from the poor conductivity caused by a large number of defects, GO and rGO exhibit poor performance in RRAM. To overcome this issue, a material with good conductivity can be used to improve the conductivity of GO or rGO. As a member of graphene-like materials, molybdenum disulfide (MoS_2) is an appropriate additive due to its good electrical conductivity and easily obtained in solution. In this paper, MoS_2 was synthesized and introduced into GO in different ways to fabricate the memory devices. After the effective mixture of MoS_2 and GO, the device exhibited a memristor performance, with the on/off ratio of 20, which dramatically changed the poor performance of pure GO in memristor. In order to further improve the poor conductivity of GO and solve the problems caused by defects, GO powder, thiourea and sodium molybdate were simultaneously used to participate in the reduction reaction to form rGO-MoS_2. MoS_2 microspheres adhere tightly to the rGO sheets participating in the charge trapping and releasing process between rGO sheets while increasing the conductivity of the system. An outstanding memory performance was obtained from rGO-MoS_2-based memory device showing an extremely high on/off ratio of 1000 which is 50 times higher than before. The results indicate that rGO-MoS_2 has great application potential in the resistive memory which plays an important role in the subsequent research on RRAM.

Biography

Minghui Cao is a PhD candidate in School of Electronic and Information Engineering from Xi'an Jiaotong University. She is pursuing her Doctor's degree in Electronic Science and Technology. Her research interests include the preparation of flexible nano-materials and their applications in wearable devices.

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The effect of hydrolyzed cellulose pulp as a filler for LPDE

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The non-edible nature of cellulose, its abundance as available material in the form of wood or agriculture residues and its renewable character makes this natural polymer an interesting material to be used as environmental friendly reinforcement filler for conventional polymers. The cellulose fibers due to their mechanical characteristics can improve the mechanical behavior of current polyolefins (e.g. PP, PE) if enough interaction between structures is provided. Besides improving the polyolefins performance, depending on the degree of incorporation, cellulose fibers could also accelerate the biodegradation process of these materials. Much of the works described the use of cellulose in the forms of micro-fibrillated or nano-cellulose which is kind of cellulose much more expensive than cellulose pulp used in paper production. Taking into account the possible industrialization of this type of reinforcement, it is important to get a much more available kind of cellulose starting as close as possible from native cellulose. In this work, we hydrolyzed cellulose pulp using sulphuric acid method to a powder form and prepared mixtures of this material with Low Density Polyethylene (LDPE) in order to evaluate the effect on the mechanical properties. Homogeneous mixtures were achieved even with 30% of cellulose incorporation. The effect of amount of cellulose and the presence of commercial compatibilizers on the mechanical properties of the composites will be described.

Biography

Jorge F J Coelho has completed his graduation from the Faculty of Science and Technology, University of Coimbra, Portugal, in Chemical Engineering. In 2006, he has completed his PhD from the University of Coimbra working on new reversible deactivation radical polymerization methods for vinyl chloride. He is an Assistant Professor with aggregation at the University of Coimbra. He has co-authored 131 peer-reviewed research papers, 11 book chapters and 2 granted international patents. His research interests include reversible deactivation radical polymerization, bio-based and biodegradable polymers, novel pharmaceutical products, supra-molecular chemistry and scale-up approaches for reversible deactivation radical polymerization.

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Arina A Sukhova et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Preparation and properties of chitosan/nano-diamond solutions and films

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Chitosan is a de-acetylated derivative of chitin, a naturally abundant polysaccharide, which is found in the exoskeleton of crustaceans and insects and in fungi cell walls. Application of chitosan in tissue engineering and regenerative medicine has a great potential due to its excellent biocompatibility, biodegradability and antimicrobial activity. Nano-diamonds were firstly produced by detonation technique, and they have good biocompatibility and mechanical properties. Nano-diamonds could be incorporated in chitosan to enhance its mechanical properties for use in bone tissue engineering. Carboxyl groups, appearing on the surface of nano-diamonds during the synthesis and purification processes, provide an effective ionic binding with chitosan amino groups. Properties of chitosan/nano-diamond solutions and films prepared using solution casting method depend on the individual features of the components and uniformity of the nanoparticles distribution. The purpose of this study is to find the relationship between the rheological properties of the chitosan/nano-diamond solutions in different acids, the way of nano-diamond incorporation to the solution and the mechanical properties, morphology, and structure of the composite films.

Biography

Arina A Sukhova is currently conducting Doctoral Research at the Institute of Macromolecular Compounds of the Russian Academy of Sciences under the supervision of Dr. Yury A Skorik. She has completed her MS in Biotechnology in 2010 from the St. Petersburg Chemical Pharmaceutical Academy. Her current research interests involve nano-composites based on biopolymers.

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Regenerated cellulose fibers spun from 1-ethyl-3-methylimidazolium diethyl phosphate/dimethyl sulfoxide co-solvent systems

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Ionic Liquids (ILs) after reported by Swatloski, et al. in 2002 have drawn much attention as solvents for cellulose. However, the viscosity of cellulose/ILs solutions is relatively high, which requires longer solubilization time leading to high cost and negative effect on spinning. Some works about the addition of co-solvents into cellulose/ILs solution systems have been reported aiming to reduce the viscosity of the solutions. The addition of highly polar aprotic solvents such as dimethylformamide and Dimethyl Sulfoxide (DMSO) to ILs was found to possibly decrease the viscosity of cellulose solutions. Moreover, some reports showed that co-solvents could accelerate the dissolution of cellulose, which was particularly favorable for cellulose processing. However, to the best of our knowledge, there are few works concentrating on the final properties of cellulose regenerated cellulose fibers spun from ILs/co-solvents systems. Herein, in this study, regenerated cellulose fibers were prepared from co-solvent system consisting of a kind of imidazolium ILs, 1-Ethyl-3-Methylimidazolium Diethyl Phosphate (EMIMDEP) and DMSO via dry-jet wet spinning. The spinnability of spinning dopes, mechanical properties, structures and fibrillation behaviors of the regenerated fibers were investigated by comparing with pure EMIMDEP system. The results showed that the spinnability determined by the maximum winding speed reduced to less than half of that for cellulose/EMIMDEP solution after addition of 30 wt% DMSO. This may be derived from reduction of elongation viscosity, which leads to decrease in strength of spinning line under elongation flow. Moreover, regenerated cellulose fibers spun from EMIMDEP/DMSO 70/30 (wt/wt) showed lower tensile strength and Young's modulus, but superior fibrillation resistance. This was thought to be related to its low crystalline orientation and low degree of crystallinity.

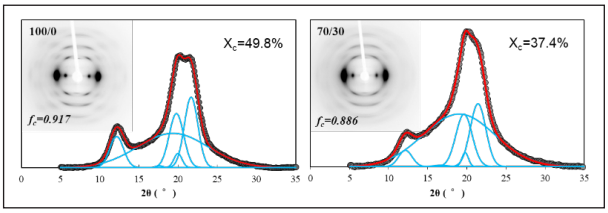

Figure-1: WAXD profiles with de-convoluted peaks for powdered regenerated cellulose fibers spun from EMIMDEP/DMSO solutions (100/0 (left image) and 70/30 wt/wt (right image)). X-ray fiber photographs of aligned fibers were also put in the figures.

Biography

Jiaping Zhang is a PhD student in Shinshu University, Japan. She studies mainly about the preparation of high performance regenerated cellulose fibers and ultrafine regenerated cellulose nonwoven fabrics in the Department of Materials Science and Engineering. She belongs to global leader program for fiber renaissance, which aims to cultivate young researchers with broader perspective, leadership and management skills.

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Benjamin I Imasogie, Res. Rev. J Mat. Sci. 2018, Volume 6
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Effect of degeneracy in graphite particle aspect ratio (AR) on some mechanical properties of as-cast spheroidal graphite iron (SGI)-compacted graphite iron (CGI) cast iron series

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Statement of the Problem: Spheroidal Graphite Iron (SGI) and Compacted Graphite Iron (CGI) castings and their derivatives have proven to be the cost-effective materials of choice and/or potential alternatives to other conventional/competing materials (e.g. malleable iron, steel, aluminum, etc., castings) and manufacturing processes (forging, machining, fabrication, etc.) in many automotive and industrial applications, with either an outright improvement in service performance or lower production cost or both. The general properties of this set of engineering purpose cast irons (often used as-cast) depend largely on the relative amount, distribution, structure and morphology of the characteristic graphite component, thus impacting significant measure of ductility in the system. Chemistry and processing of the melt dictate both the desirable graphite structure/morphology and the matrix structure during solidification. However, occasionally, consistent and uniquely spheroidal or compacted form-types of graphite required, are not readily obtained in regular production of these irons. This may result from insufficient or excessive melt treatment, choice and mode of addition of the graphite nodularising treatment agent, non-uniform treatment or the presence of inhibiting elements.

Methodology & Theoretical Orientation: A range of un-alloyed SGI-CGI iron grades were produced in a series of systematic iron-melt treatments with a special Ca-CaC2-Mg master alloy. Data sets are presented and analyzed to gauge the effect of variation in graphite particle Aspect Ratio (AR) range in an as-cast SGI-CGI iron series ranging from ASTM type I (fully spheroidal) to ASTM types II-III-IV (mixture of spheroidal and compacted/vermicular graphite forms) on some of their selected mechanical properties.

Findings: It was observed that generally, properties relating to strength and ductility progressively decrease as the proportion of non-nodular graphite (AR≤0.65) increases. In particular, properties relating to failure (tensile and fatigue strengths) are more affected by small amounts of such irregular graphite forms than properties (proof strength, etc.) not involving failure.

Conclusion & Significance: This research has established that in general, the level of graphite spheroidization or nodularization (as measured by the graphite particle AR), plays a significant role in determining the resulting mechanical properties in the SGI-CGI family spectrum. Conversely, increasing amounts of non-spheroidal graphite particles, either in the compacted or degenerate form (vermicular) caused progressive reductions in tensile and yield strengths, ductility (% elongation), notch impact values, fatigue limit and modulus of elasticity. Thus, the level of graphite spheroidization in either the optimum SGI or CGI is critical to its consideration for applications in functional components in automobile, heavy machinery, etc. and in applications where some degree of toughness is required.

Biography

Benjamin I Imasogie has special interest and expertise in the development and characterization of ductile iron; DI (also known as spheroidal (SGI) or nodular graphite iron (NGI), Austempered Ductile Iron (ADI) and nanostructured (LIGA-Ni-Fe MEMS) engineering materials. He has written and presented several scholarly papers on these topics in high impact materials science and engineering journals such as MST, SJM, JMEPEG-ASM, Materials Performance (MP), JMMCE, ACMM, MEJ, NJMSE, Acta Materialia, Metall. and Matls. Trans., Mater. Sci. and Engg. A, etc. With respect to the pertinent paper, he is the Author of the special resource material. He is the current Dean, Faculty of Technology, Obafemi Awolowo University, Ile-Ife, Nigeria. He is a Professor of Materials Engineering in this renowned University. He is a Fellow of the Nigerian Society of Engineers (FNSE) and the Nigerian Metallurgical Society (FNMS).

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Microstructural development in nanoferrites

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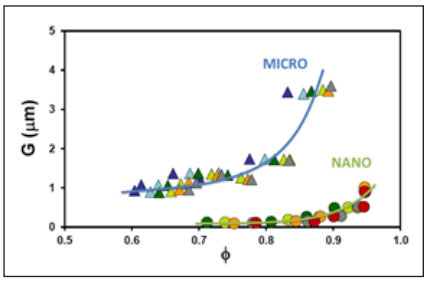
Chemical Engineering Department. Jaume I University of Castellón, SPAIN



Physical properties of advanced ceramics, as soft ferrites, are strongly dependent on its microstructure. Usually, final microstructure for advanced sintered materials requires high relative density (porosity close to zero), small average grain size and narrow grain size distribution in order to get good final physical properties. This paper shows the relationships between these microstructural variables (relative density and average grain size) and process parameters (compaction process parameter, as for instance pressing pressure, and thermal cycle, including sintering temperature and dwell time), using a nanoparticulated ferrite as raw material. NANO powder has been obtained by high-energy milling of ferrite industrial pellets. Sintered microstructure has been observed by Scanning Electron Microscopy (SEM), obtaining the average grain size by image analysis of the SEM micrographs. Relative density was determined by the Archimedes method, using true density material value. The relationships that have been founded between both microstructural variables (average grain size and relative density) have a similar mathematical form than the ones shown in literature when a microparticulated ferrite powder is used. The main conclusion is that NANO particulated ferrites allowed to obtain sintered bodies with a higher relative density and lower grain growth than the ones obtained from MICRO particulated ferrites, which may have a straight influence on final physical properties, probably enhancing them, as has been observed in sintered bodies from MICRO powders.

Aknowledgements

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Biography

Antonio Barba has done PhD in Chemistry and Full Professor of Chemical Engineering at the Jaume I University of Castellón (UJI). His research is focused on the application of the chemical engineering principles to the ceramic materials production processes, which is developed in the Chemical Engineering Department since 1986. He has collaborated in more than 90 research projects, funded both by public agencies and by private companies. The results of research are published in 6 books and more than 100 scientific papers.

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Jae-Moon Im et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Evaluation of mechanical properties of carbon fiber considering size effect

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In this study, the mechanical properties of carbon fiber were evaluated considering the size effect. The material properties tend to degrade as geometric shapes increase due to size effect. Therefore, when designing a structure that maximizes weight, such as a composite pressure vessel, it is necessary to consider properties degradation due to size effect. The carbon fiber used in this study is developed by Hyosung of Republic of Korea and has elastic modulus of 250 GPa and tensile strength of 5,500 MPa. In order to verify size effect, type 4 composite pressure vessels of 250 mm in diameter and 500 mm in diameter were selected. The composite pressure vessels were manufactured by filament winding method. The mechanical properties of carbon fiber were evaluated by hydraulic test for composite pressure vessels.

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