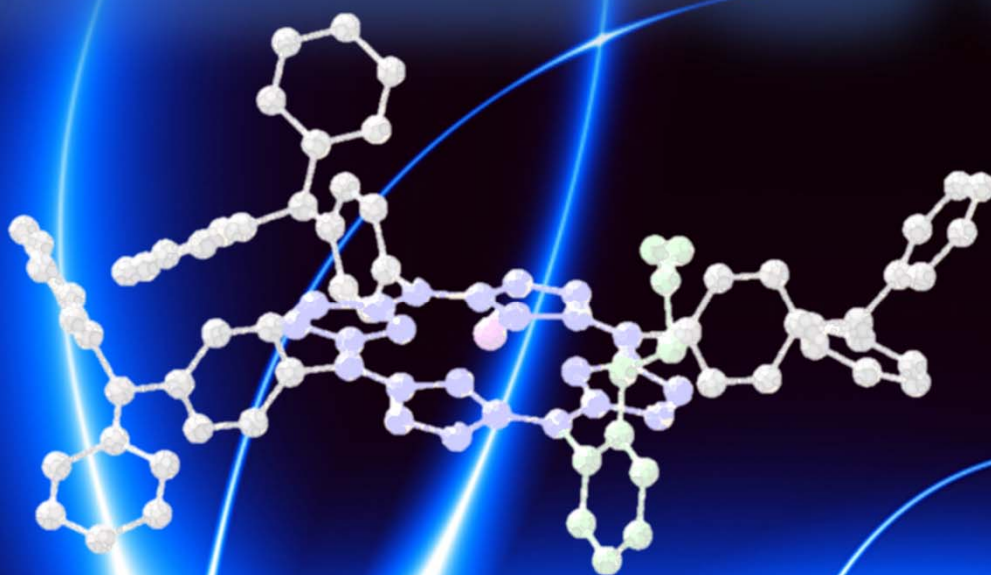
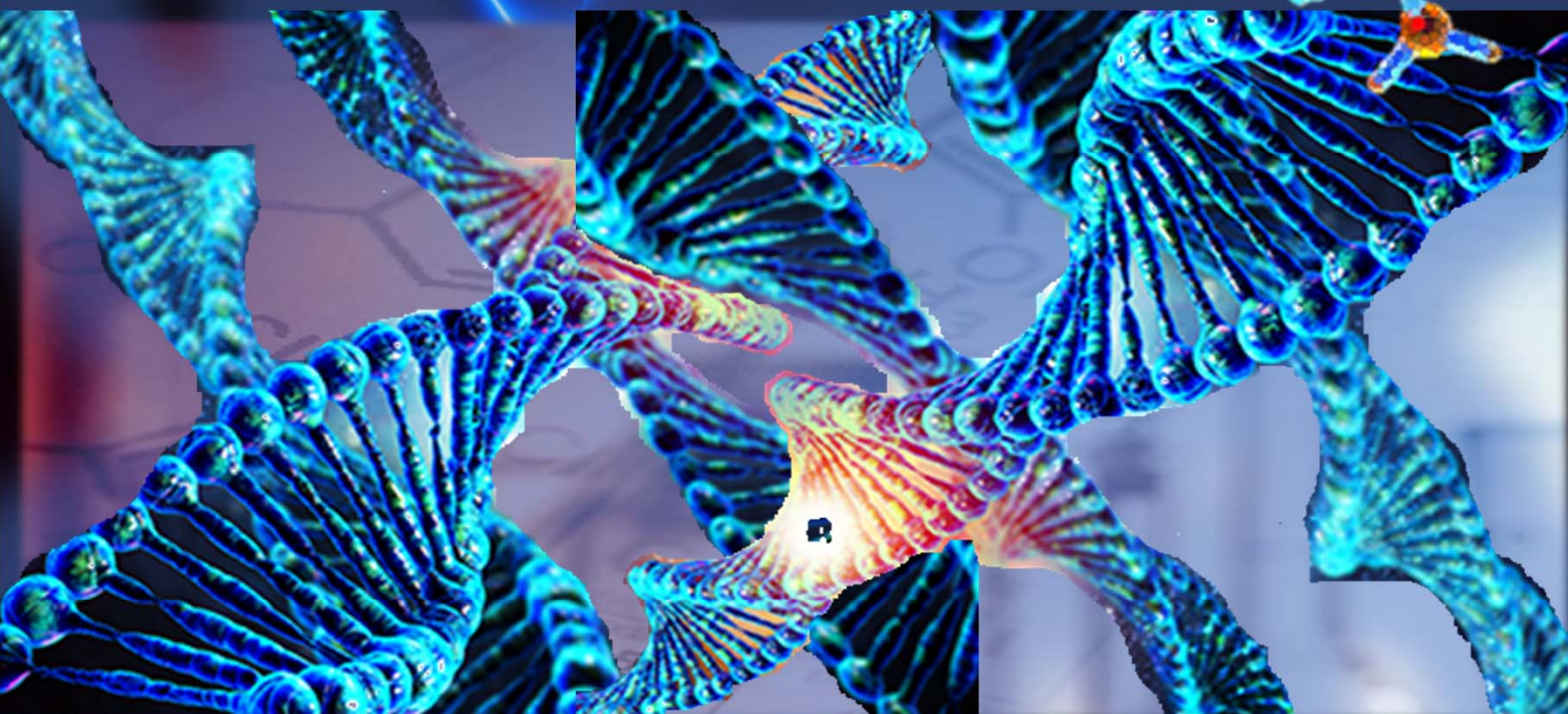


Progress in Polymer Science and Engineering



Progress in Polymer Science and Engineering

Progress in Polymer Science and Engineering

Edited by

Concepción Valencia Barragán

F. Javier Navarro Domínguez

José M. Franco Gómez

Centro de Investigación en Tecnología de Productos y Procesos Químicos (Pro2TecS).
Departamento de Ingeniería Química, Universidad de Huelva.

GRUPO ESPECIALIZADO DE POLÍMEROS (RSEQ Y RSEF)

Huelva, 2018

© de la Edición: Concepción Valencia Barragán, Francisco J. Navarro Domínguez, José M. Franco Gómez

© de las contribuciones: Los autores

I.S.B.N. 978-84-16621-78-1

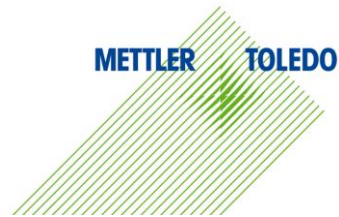


Esta publicación está disponible bajo licencia Reconocimiento-NoComercial-SinObraDerivada (CC BY-NC-ND). Se permite descargar la obra y compartirla con otras personas, siempre que se reconozca su autoría, pero no se puede modificar de ninguna manera ni puede utilizarse comercialmente.

Sponsors



Universidad
de Huelva



Preface

Following the tradition of the previous and successful Meetings, GEP 2018 is organized with the auspice of the Specialized Group of Polymers (GEP) of the Royal Spanish Society of Physics (RSEF) and the Royal Spanish Society of Chemistry (RSEQ), and will be held in Punta Umbría (Huelva) on September, 24th-27th. This XV edition of the GEP Meeting is intended to be, as those that preceded it, an opportunity for an intense exchange of information on recent advances in Polymer Science and Engineering.

About 130 communications will be presented, from which, 74 have been selected as oral communications by the Scientific Committee. The scientific program also includes five invited lectures. This book contains manuscripts from most of the submitted and invited contributions that will be presented at GEP 2018. To all authors, our acknowledgment for the effort in the preparation of the manuscripts in time.

The editors also acknowledge the Scientific Committee for their kind collaboration. Finally, we would like to express our gratitude to the whole Organizing Committee of GEP 2018 for their commitment and hard work.

The Editors

Contents

Invited lectures

The route to double and triple crystalline polymeric superstructures: Templating polymer crystallization in diblock copolymers and triblock terpolymers
Alejandro J. Müller 3

What does “sustainable” mean in the polymer context?
Anthony J. Ryan 5

70 years of polymers in our country. Challenges in the academy and in the industry
Carmen Mijangos 7

Reconstructing the cell-matrix and cell-cell interfaces with synthetic materials
Aránzazu del Campo 9

Synthesis and characterization of polymers

Supramolecular amphiphilic linear-dendritic block copolymers self-assemblies as stimuable nanocarriers
M. Abad, A. Martínez, L. Oriol, M. Piñol 13

Development of novel covalent organic frameworks
J.L. Segura, S. Royuela, A. de la Peña, M.J. Mancheño, M. Alonso, P. García Arroyo, F. Zamora, C. Seoane, M.M. Ramos 15

Self-assembled amphiphilic elastin like diblock co-recombinamer: Insights into hierarchical nanostructuring
S. Acosta-Rodríguez, L. Poocha, M. Alonso, JC. Rodríguez-Cabello 17

A comprehensive study of Microwave initiated solution copolymerization of MMA/BA: Effect on reactivity ratios
B.T. Pérez-Martínez, R. Tomovska 19

Advanced TGA techniques in the characterization of polymers
C. Gracia-Fernández 21

| | |
|---|----|
| Resolving the interphase of hierarchical composites of graphene/iPP and carbon fibres by nanoindentation <i>P. Enrique-Jimenez, S. Quiles-Diaz, H. J. Salavagione, M.A. Gómez-Fatou, F. Ania, A. Flores</i> | 23 |
| Novel anti-inflammatory surface coatings combining GAGs and amphiphilic copolymer-based nanoparticles multilayers <i>E. Espinosa-Cano, H. Al-Khoury, MR. Aguilar, A. González-Gómez, F. Syrowatka, G. Schmidt, T. Groth, J. San Román</i> | 25 |
| Dual-curable click thermosets with custom tailored properties <i>O. Konuray, À. Serra, X. Fernández-Francos, J.M. Salla, J.M. Morancho, X. Ramis</i> | 27 |
| Synthesis of PET using organocatalysis <i>I. Flores, H. Sardon, A. J. Müller</i> | 29 |
| Fundamentals and computer programs for prediction and analysis of experimental data in size-exclusion chromatography with multiple detection. Determination of conformational parameters <i>J.G. Hernández Cifre, J. García de la Torre</i> | 31 |
| Synthesis of acrylic PSAs by free radical polymerization <i>O. Llorente, L. Irusta, A. González, J.R. Leiza, M. Olaso, I. Calvo, A. Agirre</i> | 33 |
| Electrostatic interaction for high performance of waterborne coatings <i>M. Argaiz, M. Aguirre, R. Tomovska</i> | 35 |
| Thermo-reversible PCL-based supramolecular polyurethanes with self-healing and shape memory behaviour <i>F. Muscas, V. Sessini, R. Navarro, R.P. Aparicio, J.L. Valentín, A. González-Jiménez, L. Peponi, A.J. López, J. Rams, A. Ureña, A. Marcos-Fernández</i> | 37 |
| Improvement in gas transport performance of porous polyphenylenes/polycarbonate mixed matrix membranes <i>L. Rodríguez-Jardón, M. Iglesias, E.M. Maya, M. López-González</i> | 39 |
| Cu(0) wire-catalyzed SET-LRP of the hydrophobic biobased menthyl acrylate <i>N. Bensabeh, J.C. Ronda, M. Galià, V. Cádiz, V. Percec, G. Lligadas</i> | 41 |
| Preparation of thermoplastic polyurethanes from macroglycols obtained from recycled PET <i>R. Navarro, R. Miguel-Aleza, R. Seoane-Rivero, J.M. Cuevas, A. Asueta, A. Marcos-Fernández</i> | 43 |
| Incorporation of hydrogen bonding for high performance waterborne coatings <i>N. Jimenez, N. Ballard, J.M. Asua</i> | 45 |

| | |
|---|----|
| Effect of mesoporous SBA-15 content in the catalytic characteristics and properties of in situ polymerized isotactic polypropylene (nano)composites <i>R. Barranco-García, A. García-Peñas, J. Ressia, L.M. Quinzani, E.M. Vallés, M.R. Ribeiro, J.M. Gómez-Elvira, E. Pérez, M.L. Cerrada</i> | 47 |
| Lipase catalysed functionalization of polyol polyesters for potential UV crosslinked elastomers <i>A. Sonseca, A. Muñoz-Bonilla, L. Peponi, M. Fernández-García, D. López</i> | 49 |
| Chiroptical polymer switch triggered by chiral teleinduction <i>Rafael Rodríguez, Emilio Quiñoá, Félix Freire</i> | 51 |
| An introduction of scientific instruments for polymers and biopolymers characterization <i>Jesús C. Puebla</i> | 53 |
| Photoisomerization of azobenzene via naphthalene antenna effect in amphiphilic block copolymer nanocarriers <i>Hugo García-Juan, Bruno Grandinetti, Milagros Piñol, Luis Oriol</i> | 55 |
| Polythiourethane networks obtained by controlled thiol-isocyanate click reaction <i>F. Gamardella, X. Ramis, S. De la Flor, A. Serra</i> | 57 |
| Azobenzene-based block copolymers: red and green photoresponse behaviour and self-assembly properties in water <i>Hugo García-Juan, Bruno Grandinetti, Luis Oriol, Milagros Piñol</i> | 59 |
| Polyurethane-copper complex hybrids: physicochemical, mechanical and biological properties <i>J.F. Xool-Tamayo, R.F. Vargas-Coronado, J.M. Cervantes-Uc, J.V. Cauich-Rodríguez, M. Vazquez-Lepe</i> | 61 |
| Synthesis and self-assembly of poly[bis(trifluoroethoxy)phosphazene]-b-poly(2-ethyl-2-oxazoline) block copolymers <i>Alba S. Condado, Raquel de la Campa, Gabino A. Carriedo, Alejandro Presa Soto</i> | 63 |
| Photo-responsive polyurethanes reinforced with coumarin modified silica nanoparticles <i>D. López, C. Salgado, M. P. Arrieta, L. Peponi, M. Fernández-García</i> | 65 |
| Dielectric segmental dynamics of thermal-photo curable thiol-ene/thiol-epoxy thermosets <i>J.D. Badía, C. Acebo, R. Teruel-Juanes, O. Gil-Castell, A. Serra, A. Ribes-Greus</i> | 67 |
| Segmented polyurethanes derived from glucose for sustainable coating <i>M. García-Mestre, E. Zakharova, A. Martínez de Ilarduya, S. Muñoz-Guerra</i> | 69 |
| Macromonomers, telechelics and more complex architectures of PMA and PBA by a combination of biphasic SET-LRP and biphasic esterification <i>A. Moreno, R. L. Jezorek, T. Liu, M. Galià, G. Lligadas, V. Percec</i> | 71 |

| | |
|---|----|
| Novel green cationic polyfluorene: synthesis, characterization and its applications as membrane probes <i>R. Mallavia, R. Vazquez-Guilló, M.J. Martínez-Tomé, A. Falco, C.R. Mateo</i> | 73 |
| Synthesis and characterization of new polynorbornenes with aromatic dicarboximide side moieties <i>Karen A. Peñaloza, Isabel Ruiz, Joel Vargas, Arlette A. Santiago, Mohamed Abatal, Mar López-González</i> | 75 |
| Hard/soft nanostructured polymer surfaces obtained by copolymerization in nanoporous AAO reactors <i>Laia León, Juan M. Giussi, Carmen Mijangos</i> | 77 |
| Ion diffusivity study of Li ⁺ in photocrosslinked gel polymer electrolytes <i>J.L. Pablos, T. Corrales, P. Tiemblo, N. García, L. Garrido, J. Guzmán, F. Catalina</i> | 79 |
| Analysis of dielectric properties of PMMA/PEDOT blends <i>M.J. Sanchis, M. Carsí, B. Redondo-Foj, P. Ortiz-Serna, M. Culebras, R. Muñoz-Espí, A. Cantarero, C.M. Gómez</i> | 81 |
| Synthesis and self-assembly of poly[bis(trifluoroethoxy)phosphazene]-b-polystyrene block copolymers <i>Luis Quirós Montes, Raquel de la Campa, Gabino A. Carriedo, Alejandro Presa Soto</i> | 83 |
| Characterization of sequential dual-curing of thiol-acrylate-epoxy systems with controlled thermal properties <i>Claudio Russo, Angels Serra, Xavier Fernández-Francos, Silvia de la Flor</i> | 85 |
| A flash DSC study of the amorphous fraction in a semiconducting polymer <i>S. Marina, J. Martín</i> | 87 |
| Controlled β -phase formation in PVDF by blending with PMMA <i>A. Martínez-Gómez, A. Febrero, E. Afonso, P. Tiemblo, N. García</i> | 89 |
| Biodegradable polymers, biopolymers and biomaterials | |
| Is this a good bioink? Designing printable medical adhesive <i>Małgorzata K. Włodarczyk-Biegun, Julieta Paez, Jun Feng, María Villiou, Aránzazu del Campo</i> | 93 |
| In vivo biocompatible and bioadhesive interpenetrated scaffolds for wound closure and tissue regeneration processes <i>María Puertas-Bartolomé, Lorena Benito-Garzón, Stephanie Fung, Joachim Kohn, Blanca Vázquez-Lasa, Julio San Román</i> | 95 |

| | |
|---|-----|
| Synthesis and biological characterization of 3D bioprinted scaffolds using novel phytate crosslinker <i>Ana Mora-Boza, Małgorzata K. Włodarczyk-Biegun, Aránzazu del Campo, Blanca Vázquez-Lasa, Julio San Román</i> | 97 |
| Structure and crystallization of poly(butylene succinate-ran-butylene azelate) random isodimorphic copolyesters <i>I. Arandia, A. Mugica, M. Zubitur, A. Arbe, A. Alegria, G. Liu, D. Wang, R. Mincheva, P. Dubois, A.J. Müller</i> | 99 |
| Potential of lignocellulosic fractions from <i>Posidonia oceanica</i> to improve barrier and mechanical properties of bio-based packaging materials <i>I. Benito-González, A. López-Rubio, M. Martínez-Sanz</i> | 101 |
| Bioplastics from wool proteins <i>B. Fernández-d'Arlas, A. Eceiza</i> | 103 |
| Synthesis of amphiphilic graft-copolymers derived of globalide and α -amino acids <i>E. Tinajero-Díaz, A. Martínez-de Ilarduya, Andreas Heise, S. Muñoz-Guerra</i> | 105 |
| Design and development of new hyaluronic acid-chitosan hydrogels for cartilage regeneration <i>L. García-Fernández, A. Torrent, E. Montell, J. San Román</i> | 107 |
| Synthesis of poly(butylene succinate-co- ϵ -caprolactone) copolyesters by enzymatic polymerization <i>M. Nuñez, A. Martínez de Ilarduya, S. Muñoz-Guerra</i> | 109 |
| PHA-based blends and composites: new materials for sustainable packaging applications <i>L. Cabedo, E. Sánchez-Safont, A. Aldureid, T. Aznar, A. Arrillaga, J. Anakabe, S. Torres-Giner, J.M. Lagarón, J. Gámez-Pérez</i> | 111 |
| Random and oriented electrospun fibers based on a multicomponent, in situ clickable elastin-like recombinamer system for dermal tissue engineering <i>Israel González de Torre, Arturo Ibáñez-Fonseca, Luis Quintanilla, Matilde Alonso, José Carlos Rodríguez-Cabello</i> | 113 |
| Novel biodegradable NIR responsive diblock copolymers for drug delivery systems <i>A. Roche, E. Terriac, A. del Campo, R.M. Tejedor, L. Oriol, M. Piñol</i> | 115 |
| Ferrogels coated with multilayered polyelectrolytes from natural resources <i>J.S. González, G. Goya, C. Mijangos, R. Hernández</i> | 117 |
| Development of coupling agents to improve compatibility of PLA composites reinforced with cellulose fibres <i>R. Serrat, H. Oliver-Ortega, M. Delgado-Aguilar, Q. Tarrés, P. Mutjé, J.A. Méndez</i> | 119 |

| | |
|---|-----|
| Studying crack formation on cast films of PLLA/PEO blends <i>J. Martínez-Salazar, J.F. Vega, A. Espasa-Valdepeñas, V. Souza-Egipsy, A. J. Müller</i> | 121 |
| Blends based on poly(ϵ -caprolactone)/high density polyethylene: crystalline features, mechanical response and gas transport properties <i>E. Blázquez-Blázquez, V. Lorenzo, E. Pérez, M. L. Cerrada</i> | 123 |
| Biphasic ELR-based matrix for the regeneration of osteochondral lesions: the harmonization of matrix resorption to the different metabolic activity of the embedded cell type <i>J. Carlos Rodríguez-Cabello, Aurelio Vega, Ángel Gato, Gonzalo Martínez-Municio, Tatiana Flora, Matilde Alonso, Israel González</i> | 125 |
| Using proteomics for Sr-enriched biomaterial development <i>F. Romero-Gavilán, N. Araújo-Gomes, I. García-Amáez, C. Martínez-Ramos, J.J. Martín de Llano, F. Elortza, I. Goñi, M. Gurruchaga, J. Suay</i> | 127 |
| Elastine-like recombinamers hydrogels with improved mucoadhesive properties for biomedical applications <i>M. Santos, T. Postigo, M. Alonso, F.J. Arias</i> | 129 |
| Polymeric chemosensor for the detection and quantification of chloride in human sweat. Application to the diagnosis of cystic fibrosis <i>Saúl Vallejos, Elsa Hernando, Miriam Trigo, Félix García, María García-Valverde, David Iturbe, María Jesús Cabero, Roberto Quesada, José Miguel García</i> | 131 |
| Influence of chain topology (cyclic versus linear) on the crystallization of polylactide <i>N. Zaldua, M. Zubitur, A. Mugica, A. Arbe, O. Coulembier, A. J. Müller</i> | 133 |
| Polycationic polymers with DNA-condensation capability for gene delivery <i>E. Benito, L. Romero-Azogil, M.G. García-Martín, I. Molina-Pinilla, K. Hakkou, M. Bueno, J.A. Galbis</i> | 135 |
| Linear cationic polymers as non-viral carriers for DNA delivery <i>I. Molina-Pinilla, K. Hakkou, M. Bueno-Martínez, E. Benito, L. Romero-Azogil, M.G. García-Martín</i> | 137 |
| Preparation of bilayered scaffolds made of PLGA, hyaluronic acid and bioactive Sr/Zn-folates for tissue engineering <i>G. Asensio, R. Ramírez, J. González, C. Abradelo, J. San Román, L. Rojo</i> | 139 |
| Biodegradable azobenzene based materials for colonic targeting <i>I. Molina-Pinilla, K. Hakkou, Cristian Rangel, M. Bueno-Martínez, A. Alcudia, B. Begines</i> | 141 |
| New epoxy thermosets derived from clove oil prepared by thiol-epoxy curing <i>D. Guzmán, A. Serra, S. de la Flor, X. Ramis, X. Fernández-Francos</i> | 143 |

| | |
|--|-----|
| Development and characterisation of chitosan-based membranes for proton exchange fuel cells <i>F. Arenga, R. Teruel-Juanes, A. M-Salaberria, J. P. Colembergue, O. Gil-Castell, J.D. Badia, M.G. Baschetti, J. Labidi, A. Ribes-Greus</i> | 145 |
| Preparation of chitosan isothiocyanates to be used as thickener in biolubricant formulations <i>M.A. Delgado, J.M. Franco, C. Valencia</i> | 147 |
| Stimuli cleavable bio-based thermoplastic block copolymers <i>P.M. Verdugo, J.C. Ronda, G. Lligadas, M. Galià, V. Cádiz</i> | 149 |
| Smart polymeric nanoparticles as controlled drug delivery systems: drug loading and pH-dependent release of pilocarpine <i>E. Galbis, N. Iglesias, M.-V. de-Paz, R. Lucas, E. Tinajero-Díaz, S. Muñoz-Guerra, J. A. Galbis</i> | 151 |
| Kinetics of the thermal degradation of PLA and ABS blends <i>F. Carrasco, M. Sánchez-Soto, O.O. Santana, J. Cailloux, M. Ll. MasPOCH</i> | 153 |
| Flexural and impact properties of PA11-SGW composites <i>H. Oliver, R. Serrat, M. Delgado-Aguilar, Q. Tarrés, J.A. Méndez, P. Mutjé</i> | 155 |
| Structural characteristics of side-stream lignins from fast-growing poplar in respect to their valorization <i>R. Martín-Sampedro, J.I. Santos, U. Fillat, H. Sixto, I. Cañellas, M.E. Eugenio, D. Ibarra</i> | 157 |
| Reversible pH-sensitive chitosan-based hydrogels. Influence of dispersion composition on rheological properties and sustained drug delivery <i>N. Iglesias, E. Galbis, C. Valencia, M.-V. de Paz, J. A. Galbis</i> | 159 |
| Nanofibers of PMVEMA derivatives used in topical administration <i>C. Sainz-Urruela, L. Martinez-Ortega, M. Rubio-Camacho, C.R. Mateo, A. Falco, R. Mallavia</i> | 161 |
| Nanoparticles made of alkyltrimethylphosphonium-hyaluronic acid complexes: structural analysis and modelling <i>A. Gamarra, S. León, M.T. Casas, S. Muñoz-Guerra</i> | 163 |
| Hyaluronic acid/chitosan titanium multilayers with antibacterial properties <i>A. Valverde, L. Pérez-Álvarez, L. Ruiz-Rubio, M. B. Belen, M.I. Moreno, L.M. León, J.L. Vilas-Vilela</i> | 165 |
| The effect of H ₂ O ₂ on chemical and thermal properties of PLA containing TiO ₂ particles after visible-LED light exposure <i>Juan Urbano, J.E. Martín-Alfonso, JM. Franco</i> | 167 |

| | |
|---|-----|
| Effect of the addition of κ -carrageenan on swelling and mechanical properties of methacrylate hydrogels <i>N. Pettinelli, R. Bouza, L. Barral, Y. Farrag, M. Rico, B. Montero</i> | 169 |
| Fully biobased and biodegradable plastic materials for non-biodegradable composites substitution <i>R. Serrat, H. Oliver-Ortega, M. Delgado-Aguilar, J.A. Méndez, Q. Tarrés, P. Mutjé</i> | 171 |
| Vapor phase polymerization method to develop 3D scaffolds based on PEDOT/CNT for electroactive tissue regeneration <i>Antonio Dominguez-Alfaro, Nuria Alegret, David Mecerreyes, Maurizio Prato</i> | 173 |
| Revalorization of olive tree pruning residues into cellulose nanofibers <i>U. Fillat, B. Wicklein, R. Martín-Sampedro, E. Castro, D. Ibarra, M.E. Eugenio</i> | 175 |
| Polymers and nano-technology for advanced applications | |
| Antimicrobial PNIPAM/DMAEMA microgels confined in PLA/PHB-based electrospun membranes via colloidal electrospinning <i>C. Echeverría, A. Aragón-Gutiérrez, A. Sonseca, A. Muñoz-Bonilla, M. Fernández-García, D. López</i> | 179 |
| Smart textiles functionalized with PEDOT and CNT as promising thermoelectric materials <i>José F. Serrano-Claumarchirant, Isaac Brotons, Mario Culebras, Andrés Cantarero, Clara M Gómez</i> | 181 |
| Nanometer-scale alginate hydrogels supported over multilayer polymer films as pads for phototriggered drug delivery <i>M. Criado, F. Boulmedais, C. Mijangos, R. Hernández</i> | 183 |
| Step-wise supramolecular polymerization of host-guest complexes <i>Jesús del Barrio, Oren A. Scherman</i> | 185 |
| Slippery Liquid Infused Porous Surfaces (SLIPS) based on polymer mixtures <i>E. Afonso, A. Martínez-Gómez, A. Febrero, P. Tiemblo, N. García</i> | 187 |
| Rheological evidence on the MWCNTs selective localization in PMMA-LDPE immiscible polymer matrices <i>C. Roman, M. García-Morales, T. McNally</i> | 189 |
| 4D printed liquid crystalline elastomeric actuators: artificial muscles, adaptive optical elements and soft-robotic functions <i>M. López-Valdeolivas, D. Liu, D. J. Broer, C. Sánchez-Somolinos</i> | 191 |
| Shape memory polyurethanes. Application in smart fabrics <i>Miriam Sáenz-Pérez, José M. Laza, Tariq Bashir, Mikael Skrifvars, Estibaliz Hernáez, José L. Vilas, Luis M. León</i> | 193 |

| | |
|---|-----|
| Flexible hybrid thermoelectric materials based on carbon nanotubes and poly (3,4-ethylenedioxythiophene) <i>José F. Serrano-Claumarchirant, Mario Culebras, Rafael Muñoz-Espí, Andrés Cantarero, Clara M Gómez</i> | 195 |
| Porous membranes obtained from mixtures of PVOH and gelatin via electrospinning with application in tissue engineering <i>M. Felix, V. Perez-Puyana, L. Cabrera-Correa, A. Romero, A. Guerrero</i> | 197 |
| Cyclic chain topology induces liquid crystal mesophases in poly(3-hexylthiophene) <i>J. Maiz, G. Liu, N. Delbosc, O. Coulembier, D. Wang, A. J. Müller</i> | 199 |
| Determining the composition of mixed domains in bulk heterojunctions for photovoltaics <i>Jaime Martín, Sara Marina, Daniele Cangialosi, Natalie Stingelin</i> | 201 |
| Polyurethane-based magnetic capsules for application in thermal energy storage <i>Olaia Álvarez-Bermúdez, Adrián Aguado-Hernández, Inés Adam-Cervera, Clara M. Gómez, Katharina Landfester, Rafael Muñoz-Espí</i> | 203 |
| Shape-memory behaviour in multifunctional polymeric nanocomposites <i>L. Peponi, V. Sessini, I. Navarro-Baena, M. P. Arrieta, D. López</i> | 205 |
| Novel strategies for covalent functionalization of boron nitride nanotubes with short polyethylene chains <i>S. Quiles-Díaz, Y. Martínez-Rubi, J. Guan, K. S. Kim, M. Couillard, H.J. Salavagione, M.A. Gómez-Fatou, B. Simard</i> | 207 |
| Morphology control of polymer–metal oxide hybrid nanoparticles towards the preparation of magnetically recoverable heterogeneous catalysts <i>Olaia Álvarez-Bermúdez, Ana Torres-Suay, Francisco F. Pérez-Pla, Katharina Landfester, Rafael Muñoz-Espí</i> | 209 |
| Photoacid catalyzed organic-inorganic hybrid inks for the manufacturing of Inkjet-Printed Photonic Devices <i>J. Alamán, M. López-Valdeolivas, R. Alicante, F. J. Medel, J. Silva-Treviño, J. I. Peña, C. Sánchez-Somolinos</i> | 211 |
| Cationic doping of PEDOT with 1-Cl <i>M. Sánchez, F. Estrany, C. Alemán</i> | 213 |
| Drug-loadable nanoparticles of PMVE/MA: synthesis, PEGylation and characterization <i>H. Codina, E. Galán-Solís, A. Mira, C.R. Mateo, R. Mallavia, A. Falco</i> | 215 |
| Influence of egg albumen protein load on the electrospinning of aqueous PEO solutions under different concentrations and pHs <i>J.E. Martín-Alfonso, C. Valencia, JM. Franco, A. Greiner</i> | 217 |
| Effect of the suspending medium viscosity on the electrorheological behaviour of polyaniline-graphene hybrid particles in silicone oil <i>C. Roman, M. García-Morales, M.T. Cidade</i> | 219 |

Evaluation of biodegradable superabsorbent materials from industrial by-products: soybean and blood meal
M.E. Álvarez, J.M. Aguilar, J. de la Fuente, M.L. López-Castejón, C. Bengoechea 221

Processing, industrial processes and recycling of polymers

Chain extension and crosslinking as methods for upgrading mechanically recycled PLA
F.R. Beltrán, C. Infante, M.U de la Orden, J. Martínez Urreaga 225

Effects of ageing and mechanical recycling on the thermal crystallization of poly(lactic acid)
J. Martínez Urreaga, F.R. Beltrán, V. Lorenzo, M.U de la Orden 227

An innovative organocatalyst for the depolymerisation of commodity polymers: from plastic wastes to valuable monomers
C. Jehanno, F. Ruipérez, A.P. Dove, H. Sardon 229

Multi-scale surface analysis on polypropylene micro-textured injected samples using 3D non-contact techniques
P. Gamonal-Repiso, M. Sánchez-Soto, S. Santos-Pinto, M. Ll. MasPOCH 231

Study of crosslinking process with organic peroxides to polyolefin recycled matrixes to be used in high-value applications
L.E. Alonso, K. Nuñez, M.A. Morcillo, J.C. Merino, J.M. Pastor 233

Rheological characterization of polyethylene(terephthalate) modified by reactive extrusion
M. Asensio, J. Guerrero, K. Núñez, M. Herrero, J.M. Pastor 235

Process parameters and screw configurations for compounding of feedstock and batch mixer tests on MIM materials
Bernd Jakob, Dirk Hauch 237

Integral use of *Eucalyptus globulus* in a double stage biorefinery scheme
J.M. Loaiza, A. Alfaro, J.C. García, M.T. García, M.J. Díaz, F. López 239

Rheological and mechanical properties of polymers and composite materials

Effect of carboxylated HNBR content on the compatibilization of PA6/HNBR immiscible blends. Analysis of morphology, viscoelastic behavior and mechanical properties
A. Burgoa, R. Hernández, J. L. Vilas 243

Controlled actuation in thermally-triggered free-standing shape-memory actuators
A. Belmonte, G. Lama, P.F. Cerruti, V. Ambrogi, X. Fernández-Francos, S. De la Flor 245

| | |
|--|-----|
| In situ gelification of κ -carrageenan solutions by 3D printing <i>I. Díaz, C. Gallegos, E. Brito-de la Fuente, I. Martínez, C. Valencia, M.C. Sánchez, J.M. Franco</i> | 247 |
| Thermoplastic solid electrolytes for energy storage <i>F. J. González, V. Gregorio, A. Rubio, L. Garrido, N. García, P. Tiemblo</i> | 249 |
| Tailoring PLA/PA bioblends for 3D printing applications via the manufacturing of in situ microfibrillar composite filaments <i>V. García-Masabet, J. Cailloux, O. Santana, M. Sánchez-Soto, F. Carrasco, M. Ll. MasPOCH</i> | 251 |
| Formation of sweet fennel oil-in-water emulsions stabilized by a triblock polymer (Pluronic F68) and rhamnogum <i>L.A. Trujillo-Cayado, L.A. Báez, P. Ramírez, J. Santos, M.C. Alfaro, J. Muñoz</i> | 253 |
| Approaching short time dynamics of polymer solutions by passive microrheology <i>J.F. Vega, A. Espasa-Valdepeñas, V. Cruz, J. Ramos, A.J. Müller, J. Martínez-Salazar</i> | 255 |
| An analysis of the hydrogen bonds of modified phenoxy resins by SAOS, LAOS and extensional flow <i>L. Sangroniz, A. Sangroniz, M. Fernández, A. J. Müller, A. Etxeberria, A. Santamaria</i> | 257 |
| Improvement of film formation abilities of waterborne latex particles for coating applications <i>S. M. Dron, M. Paulis</i> | 259 |
| A preliminary study of mixtures of bitumen/paraffin wax for thermal energy storage <i>J. R. Arza, A. A Cuadri, F. J. Navarro</i> | 261 |
| Thermorheological properties of cocoa creams based on cellulose ethers <i>M. Espert, L. Caloca, A. Salvador, T. Sanz, M.J. Hernández</i> | 263 |
| Enhancement of thermal conductivity by addition of several conductive fillers in thermally cured cycloaliphatic epoxy thermosets <i>I. Isam, F. Gamardella, X. Fernández-Francos, À. Serra, F. Ferrando</i> | 265 |
| Processing temperature impact on the rheological behaviour of castor oil and lignin-based polyurethanes <i>A.M. Borrero-López, F. Santiago-Medina, C. Valencia, J.M. Franco</i> | 267 |
| Effect of epoxidation on the rheology of epoxidized cellulose pulp dispersions in castor oil <i>E. Cortés-Triviño, C. Valencia, M.A. Delgado, J.M. Franco</i> | 269 |
| Enhancement of the synthesis protocol for the production of adhesives for bonding wood <i>A. Tenorio-Alfonso, M.C. Sánchez, J.M. Franco</i> | 271 |

| | |
|--|-----|
| Aging of elastomeric components of a solar thermal collector under solar radiation <i>M.C. Ferreira, G. Ritto, M.T. Cidade, M.J. Carvalho, T.C. Diamantino</i> | 273 |
| PET/PP and PET/HDPE polymer blends stabilized with titanium dioxide nanoparticles and compatibilizing agents <i>E. Matxinandiarena, L. Sangroniz, A. Mugica, M. Zubitur, A. Santamaría, A.J. Müller</i> | 275 |

Aging of elastomeric components of a solar thermal collector under solar radiation

M.C. Ferreira¹, G. Ritto², M.T. Cidade², M.J. Carvalho¹, T.C. Diamantino¹

¹ *National Laboratory of Energy and Geology, Lisbon (Portugal).*

² *Department of Materials Science, Nova University of Lisbon (Portugal)*

Introduction

Elastomeric components play important functions in solar thermal collectors (STC's) as sealings, fittings or absorbers, being important that they maintain their performance along STC lifetime. However, stress factors such as high temperatures and high levels of solar radiation, as exist in southern Europe countries, can affect the properties of those components.

A testing programme for the assessment of elastomeric materials of such components is detailed in international standards (ISO 9808 and ISO 9553), which already considers the effect of heating.

To our knowledge, there is lack of information regarding the evaluation of the effect of solar radiation as well as of the combined effect of heat and radiation on those elastomeric materials.

The work presented is part of a study [1] aiming at gathering data concerning the effect of solar radiation on elastomeric components of STC's and evaluating the necessity of introducing this factor in a more complete testing programme which is of the utmost importance for a producer of such equipments. The work was performed on two components of a commercial STC, a fitting with the function of isolating inlet and outlet connections, and a glazing sealant, both carbon black filled ethylene propylene diene terpolymer (EPDM) compounds.

In order to understand and compare the effects of solar radiation, conjugate effect of heat and solar radiation and of the laboratory light sources, the components and the solar thermal collectors

including them were exposed in two outdoor exposure testing (OET) sites in Portugal (Sines and Lumiar-Lisboa) [2]. In addition, laboratory accelerated tests, including exposure to UV fluorescent radiation and to xenon arc radiation, were performed. This paper focuses mainly on the analyses of the changes of hardness and crosslinking density upon exposure.

Experimental

The components itself were tested after 1, 2 and 3 years exposure on the two OET sites and those included in the collectors were tested after two years of exposure of the collector in stagnation conditions.

Exposure to xenon-arc radiation was done according to ISO 4892-2:2013, cycle n° 4, in an Atlas Weatherometer Ci35A with daylight (borosilicate) filters. Periods of exposure varied between 72 h and 3240 h.

Exposure to UV fluorescent radiation was done according to ISO 4892-3:2013, cycle n° 2, in a chamber Q-Lab QUV spray with a UVA-340 lamp type. Periods of exposure varied between 84 h and 4320 h.

Crosslinking density was determined by the equation of Flory-Rehner, using toluene as swelling agent [3]. The samples were immersed for 48 h, changing the solvent after 24 h.

Results presented are the average of five determinations.

Hardness (International Rubber Hardness Degrees-IHRD) was determined using a durometer Adamel Lhomargy DU.05.

Results and Discussion

It was found that in general crosslinking density increased upon exposure of the components in OET sites and to laboratory light sources, in accordance with the occurrence of photodegradation reactions.

Highest levels of crosslinking density were obtained for the samples exposed to laboratory UV radiation for longer periods.

Fitting samples in the collector showed differences according to their position, crosslinking density of those in higher position being higher than those in lower position.

Crosslinking density of the samples exposed in OET sites for two or three years approached the values determined for the same components in the collector after two years exposure in stagnation conditions.

Similar values of crosslinking density of the components after exposure in the collector were obtained after laboratory exposure. However, the source of radiation and time of test depended on the component. For example, the value of crosslinking density of the sealing from the collector exposed in Sines was reached more quickly on the exposure to Xenon-arc radiation than on the exposure to UV radiation, while for the fitting the opposite was observed.

It is expected that an increase of crosslinking density will lead to increase of hardness. However, a straightforwardly relation between these two characteristics was not always observed. This was observed in the fitting that showed higher values of hardness after Xenon-arc exposure than after UV-exposure, although values of crosslinking density in the latter case were higher. This behaviour is probably explained by the higher temperature reached in the Xenon-arc test in which black panel temperature is 63 ± 3 °C, while in the UV test is 50 ± 3 °C. Higher testing temperature can lead to loss of lower boiling point formulation components.

Aknowledgements

This work is a result of the project FCOMP-01-0124-FEDER-027507 (Ref^a FCT RECI/EMS-ENE/0170/2012) and the project POCI-01-0145-FEDER-016709 (Ref^a FCT PTDC/EMS-ENE/0578/2014) supported by COMPETE 2020 and LISBOA 2020 under the PORTUGAL 2020 Partnership Agreement through the European Regional Development Fund (ERDF) and supported by FCT through National Funds.

References

1. Ferreira, M.C., Rosado, A.R, Carvalho, M.J. and Diamantino, T.C. (2016). Assessment of Elastomeric Components of a Solar Thermal Collector. In: EuroSun 2016, ISES Conference Proceedings.
2. Diamantino, T.C., Gonçalves, R., Nunes, A., Páscoa, S., Carvalho M. J. (2017). Sol. Energy Mat. Sol. Cells 166, 27-38.
3. Kwak, S. B., Choi, N. S. (2011). Int. J. Auto. Tech-Kor. 12, 401-408.