8th ECNP International Conference on Nanostructured Polymers and Nanocomposites

Dresden, Germany
September 16 to 19, 2014

COLLECTION OF ABSTRACTS

ISBN: 978-3-9816007-1-1

How to find abstracts

Oral Presentations

Folder Oral Presentations – file 0_Oral_Program
You may get to an abstract via the link at the title of a presentation in the oral program. You get back from the abstract to the oral program via the blue BACK button at the left upper side of each abstract.

Posters

Folder Posters – file 0_List of posters
You may get to an abstract via the link at the title of the poster in the list of posters. You get back from the abstract to the poster list via the blue BACK button at the left upper side of each abstract.

Organizers:
Leibniz-Institut für Polymerforschung Dresden e.V.
Hohe Str.6, 01069 Dresden
www.ipfdd.de, +49 351 4658-282
Brigitte Voit (chair) - voit@ipfdd.de
Kerstin Wustrack (organization) - wustrack@ipfdd.de

Back

P61

ASSESSMENT OF RAFT POLYMERIZATION IN THE SYNTHESIS OF CROSSLINKED MATERIALS FOR ENERGY STORAGE

P. Tristão[1], H. Costa[1], P. Kadhirvel[1], Rolando C.S. Dias[1], M.R.P.F.N. Costa[2]

[1] *LSRE-Instituto Politécnico de Bragança, Quinta de Santa Apolónia, 5300, Bragança, Portugal*

[2] *LSRE-Faculdade de Engenharia da Universidade do Porto, Rua Roberto Frias s/n, 4200-465, Porto, Portugal*

rdias@ipb.pt

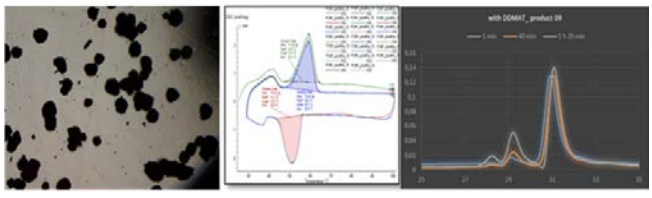
The synthesis and characterization of two different classes of polymer crosslinked materials, useful for energy storage and improving energy efficiency, is here studied. Products resulting from the encapsulation of phase change materials (PCM), which can be used for thermal energy storage/release, are considered as first case study. For this purpose, different kinds of PCM can be considered in the encapsulation process, namely renewable based PCM such as natural fatty acids (e.g. stearic/palmitic acids). The sulfur inverse-vulcanization process, producing materials with useful electrochemical properties, is considered as second case study. This latter process takes advantage of the excess of elemental sulfur that is generated in petroleum refining and allows the synthesis of sulfur-rich copolymers to be applied (e.g.) as active materials in lithium-sulfur (Li-S) batteries [1].

Encapsulation of PCM was performed in a 1 L pressurized batch reactor using MMA as monomer and EGDMA as crosslinker. An aqueous suspension process was considered. Microparticles containing PCM were thus synthesized and also characterized using FTIR and TG/DSC for thermal analysis.

The inverse-vulcanization process of elemental sulfur was carried out at high temperature (e.g 185 °C) using 1,3-diisopropenylbenzene (DIB) as crosslinker. The evolution of the crosslinking process was measured through SEC analysis of reaction samples. Formation of S-S bonds in the products was confirmed by submitting the networks to a cleavage process, using 1,4-dithio-DL-threitol as reducing agent. Products of the cleavage process were also analyzed by SEC.

In both crosslinking processes (encapsulation/inverse-vulcanization), besides classical free radical synthesis, RAFT polymerization was also considered. Our goal was the assessment of the effect of RAFT mechanism on the molecular architecture of the networks and performance of the final materials.

[1] W.J. Chung, et. al., Nature Chemistry, 5 (2013) 518.



Left: Microscopic image of PCM encapsulated particles obtained by aqueous suspension polymerization. Free radical and RAFT polymerization were both considered. Center: Cyclic DSC analysis (10 cycles) of an encapsulated PCM showing the usefulness of these materials to store/release thermal energy. Right: SEC analysis of S inverse-vulcanization products obtained in the presence of DDMAT RAFT agent.