THE INFLUENCE OF FUNCTIONALIZED MWCNT ON THE PROPERTIES OF SYNTHESISED POLY(LACTIDE)

Ivan Ristić[1*], Nevena Vukić[1], Milena Marinović-Cincović[2], Aleksandra Miletić[1], Suzana Cakić[3], Branka Pilić[1]

1. University of Novi Sad, Faculty of Technology, Bulevar cara Lazara 1, Serbia
2. University of Belgrade, Vinča Institute of Nuclear Sciences, Serbia
3. University of Nis, Faculty of Technology, Bulevar oslobodjenja 124, Serbia

*e-mail: ivancekaris@yahoo.com, corresponding Author**

Nature-based materials have provided significant opportunities and progress in medicine and pharmacy, which make additional challenges in creating biomaterials with specific properties. Many properties of polymeric materials depend on polymer topology. The topology of biodegradable polyesters can be adjusted with branched polymers synthesis, by incorporating multifunctional monomers into the polyester backbone. Final properties of the bio-based star shaped polymers can be controlled by choosing the respective chemical structure of core, depending on the required application. The molar architecture of biodegradable poly(lactide) (PLA) based polymers could be also adjusted by incorporating di-functional monomers into the polymer chains in order to obtain desired properties of final materials. To investigate the influence of multifunctional filler on the properties of PLA high performance composites, a series of multiwall carbon nanotubes (MWCNT)/PLA composite, with different contents of functionalized multiwall carbon nanotubes (f-MWCNT), were synthesized via solution ring-opening polymerization of lactide in the presence of trifluoromethanesulfonic acid as catalyst. Composites were synthesised by the "grafting from" method facilitates growth of the poly(lactide) chains from the surface of the f-MWCNT by reaction between the surface functionalities of the nanotube with the lactide monomers. The modifications of MWCNT were achieved with chemical reaction using strong acids, introducing chemical groups on the surface and by using high energy irradiation technique. FTIR analysis confirmed that ring-opening polymerization (grafting) of lactide, in controlled conditions, is possible to perform from the surface of f-MWCNT. Even a rather low content of f-MWCNT had a significant influence on thermal properties, increasing the Tg and the Tm values, of obtained PLA nanocomposites. SEM images demonstrate that the MWCNT was completely coated by the PLA layer, and that the diameter of the coated MWCNT (~30 nm) was larger than that of the pristine MWCNT (~15 nm). This suggests a strong interaction between the MWCNT and grafted PLA chains. The individual tubes were obviously separated from each other due to PLA covering and such "rods" were glued together. This indicates that the lactide ring-opening polymerisation reaction took place over the whole surface of the f- MWCNT.

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