INVESTIGATION OF POLYVINYL ALCOHOL/ CLAY NANOCOMPOSITES

POLIVINILSPIRTA/MĀLU NANOKOMPOZĪTU IZPĒTE

A.Cimmermane, S.Gaidukovs, J.Zicans, G.Mezinskis
Riga Technical University

In recent years, the campaign for the protection of the environment and the preservation of limited natural resources urged to develop high-performance natural degradable materials to replace the conventional synthetic ones. Polyvinyl alcohol is one kind of promising material with many benefits, including low cost, biodegradability, nontoxicity, and biocompatibility. Although polyvinyl alcohol can be extensively used as a valuable biopolymer not only in tissue engineering (e.g., wound-dressing, bone scaffolding), but also as paper coating, textile sizing, and flexible water-soluble packaging films, however, its poor mechanical properties (especially in the wet state) limit its application as an engineering material. Wide potential applications stimulate an interest in improving mechanical, thermal, and permeability properties of thin polyvinyl alcohol films, ultimately with the hope of retaining the optical clarity of material. Therefore, how to reinforce such materials becomes a challenge for polymer science researchers. Many attempts such as crosslinking, special orientation technique, and polyvinyl alcohol based composites filled with miscellaneaous reinforcing agents (hydroxyapatite, titanium oxide, etc.) have been made and great progress has been achieved. However, the technical properties are still not high enough and there is still a long way to go before the application of high-performance polyvinyl alcohol (PVA) polymer or polyvinyl alcohol polymer based composites is perfected.

New trends in the field of modification of polymer systems, especially, owing to developing of nanoscale hybrid structures showed itself to be very perspective. Thereby, development of novel PVA-clay nanocomposites is one of the promising ways to improve material properties to the large extent. Montmorillonite and smectite clays are naturally occurring 2:1 phyllosilicate, capable of forming stable suspensions in water. This hydrophilic character of MMT also promotes dispersion of these inorganic crystalline layers in water-soluble polymers such as polyvinyl alcohol.

Important to notice that clay is also environmentally friendly, naturally abundant and economic. To realize the combination of properties of polyvinyl alcohol and the high strength and stability of the clay, PVA–clay nanocomposites were prepared through solution blending technique in the present work. The main objective of our research is to prepare the environmentally friendly nanocomposites and to investigate the influence of the clay contents on the nanostructure and properties of the PVA–clay nanocomposites. The hybrid nanocomposites were characterized by laser scattering, wide angle x-ray diffraction. Mechanical, thermal properties of the hybrids were measured. The dispersion of clay on nanoscale in PVA matrix has a dramatic effect on the overall properties of the composite material. It is established that PVA–clay nanocomposites mechanical, thermal properties were improved due to development of material nanoscale structure.

Sergejs Gaidukovs, Riga Technical University, Institute of Polymer Materials, Azenes 14/24, Riga, LV-1048, Latvia, Phone: (+371) 7089252, e-mail: zicans@ktf.rtu.lv