N033

IN SITU POLYMERIZATION FOR THE PREPARATION OF POLYETHYLENE/SILICA-SILVER NANOCOMPOSITES WITH ANTIMICROBIAL PROPERTIES

Giovani Pavoski[1]*, Renan Kalikoski[1], Marcéo A. Milani[1], Larissa B. Capeletti[1], Ismael dos S. Belmonte[1], Henri S. Schrekker[1], João H. Z. dos Santos[1], Ignacio dell'Erba[2], Griselda B. Galland[1]

[1]Chemistry Institute, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil
[2]Instituto de Investigaciones en Ciencia y Tecnología de Materiales (INTEMA), Universidad Nacional de Mar del Plata, Mar del Plata, Argentina

*Corresponding author: giovani_2858@hotmail.com

Abstract: Within the areas of nanotechnology and materials science, polymer nanocomposites are intensively studied. In recent decades much research has been carried out using different polymer matrices and nanofillers (graphite, silver, gold, clay, silica, etc.). Metallic silver and silver based compounds have been investigated as antimicrobial agents. Polyethylene is commonly used in the medical field among others due to its characteristics of low price, chemical inertness and easy processing. The main objective of this work was to obtain nanocomposites with antifungal action, being the result of a good distribution of the Ag nanoparticles in the polymer matrix. The Ag nanoparticles were encapsulated with 3-aminopropyltrimetoxysilane (APTMS), applying different proportions of APTMS/Ag (2, 4 and 8). SEM images show that increasing ratios of APTMS/Ag resulted in the formation of smaller Ag nanoparticles (55 nm, 23 nm and 13 nm, respectively). After acidic and basic sol-gel synthesis by reaction of Si-OCH_3 of the Ag nanoparticles with Si-OH of a commercial silica, SAXS analyses also confirmed the presence of smaller Ag nanoparticles, with increasing APTMS/Ag ratios, within the silica-Ag hybrids (SiAg). Antifungal testing of SiAg nanoparticles showed activity for all of the tested materials. The nanocomposites were synthesized by *in situ* polymerization of ethylene with both non-supported and supported metallocene catalysts. The yields of the polymerizations were high, where the non-supported catalyst was more productive than the supported one. Polyethylene (PE)/SiAg nanocomposites with 1.0 to 2.4 wt.-% of SiAg were obtained. TGA showed an improvement in thermal stability for the nanocomposites, showing an increase of the initial degradation temperature of 14°C. The crystallization temperature increased 1-2 °C and the melting temperature 1-4 °C. SEM images show morphological differences between the nanocomposites prepared by either non-supported or supported systems. The nanocomposites showed also antifungal activity.

Keywords: Nanocomposites, *in situ* polymerization, polyethylene, silver nanoparticles, antimicrobial properties.