Nanocomposites and nanomaterials

X-ray study of structural formation of Silver-containing polymer nanocomposites obtained by the thermal reduction method

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Nanohybrids based on synthetic and natural polyelectrolytes containing nanoparticles of noble metals, silver, and copper manifest antibacterial and fungicidal properties and show promise as materials for medical applications.

The reduction of silver ions (Ag^+) to silver particles (Ag^0) is conventionally achieved by a chemical method using reducing agents such as $NaBH_4$, formamide, dimethylformamide, triethanolamine, hydrazine, etc. Although this method is simple and effective, the biological toxicity and the environmental hazard of the residual reducing agent are problems.

Among the various techniques developed for the synthesis of silver nanoparticles, thermal reduction is a novel method to produce polymer-metal nanocomposites. As compared to conventional methods, it is much faster, ecologically cleaner and economical.

The analysis of wide-angle X-ray diffractograms of Silver-containing nanocomposites obtained by the thermal reduction Ag+ ions from interpolyelectrolyte–metal complexes (IMC) pectin–Ag^+–polyethyleneimine in a wide temperature range (100–160 °C) showed that a increase of temperature to T = 150 °C the content of silver nanoparticles in the system increases. This is indicated by increasing the intensity of diffraction peaks at two $2\theta_m$ ~ 38.2 and 43.8, corresponding crystallographic planes face-centered cubic lattice of silver and characterized indices (111) and (200), respectively, and confirm the presence of metallic silver in the system.

With further increase in temperature reduction Ag^+ ions in IMC to T = 160 ° C the intensity of the diffraction peaks that characterize the structure of metallic silver does not change.

Thus, according to wide-angle X-ray scattering can conclude that the optimal temperature for Ag^+ ions reduction in IMC with subsequent formation of nanocomposites is 150 °C.