The influence of PVP molecular weight in the synthesisof silver nanowires using a salt-assisted polyol method

Barbara Perez Gonçalves Silva[1], Larissa Otubo[1]

[1]Instituto de Pesquisas Energéticas e Nucleares (*CECTM*)

e-mail: barbara_pe@hotmail.com

In the last decades, the demand for new materials to be used in electronic devices has increased. Among the materials that can be used in transparent conductive films (TCFs), are the silver nanowires (AgNWs). This class of material, when supported in glass or PET, e.g., has good conductivity, thermal and mechanical properties and also high transparency. In this work, the AgNWs were synthesized using the polyol method assisted by a salt and the influence of molecular weight of the capping agent polyvinylpyrrolidone (PVP) in the morphology and structure of Ag crystals was investigated. Different molecular weight of PVP (40 K, 120 K, 360 K and 1300 K MW) was used in the synthesis. The surface morphology of the products was observed by scanning electron microscopy and atomic force microscopy. The phase composition and structure were analyzed by X-ray diffraction (XRD) and the XRD patterns diffraction peaks correspond with the face-centered-cubic (fcc) crystalline phase of silver. Transmission electron microscopy was used to analyze the crystal structure, and UV-visible spectroscopy was used to follow the formation of Ag structures. The results indicate that PVP and its chain length have an important role in the formation of silver nanocrystals due to the adsorption and steric effects [1] and as high is the molecular weight of PVP, longer and thinner are the AgNWs as observed by other authors [2]. Different morphologies were obtained when changing the size of PVP chain. For smaller MW of PVP, particles and short wires were formed. Increasing the MW, nanorods and pyramidal particles were formed, and finally, forming nanowires when using the highest MW PVP of the experiments. Improving the aspect ratio of silver nanowires is important to construct TCFs, since the conductivity and transparency properties are improved when they are thinner and longer. Ref.: [1] Song, YJ., et. al, Nanoscale Res. Lett., 9, 17 (2014). [2] Yuyue Guo, et al, Inorg. Chem. Comm., 128, 108558 (2021).