Abstract No: PO-27

A systematic study on the effect of morphology of silver nanomaterials towards electrical conductivity in aqueous nanodispersions

M. J. Dheerasinghe[1], H. M. D. Nisansala [3], A. A. D. T. Abeysinghe[1], K. Rajapaksha[1], C. N. K. Patabendige[3] and N. M. S. Sirimuthu[1,2]*

[1]Department of Chemistry, University of Sri Jayewardenepura, Sri Lanka
[2]Center for Kidney Research, University of Sri Jayewardenepura, Sri Lanka
[3]Department of Biosystems Technology, University of Sri Jayewardenepura, Sri Lanka
*nmssirimuthu@sjp.ac.lk

Nanoscience is a field which has gained increasing attention of scientists in the recent past. Out of the various disciplines listed under nanotechnology, nanochemistry comes in the spotlight due to the wide array of applications in industries and other sectors. Out of different nanomaterials used, nano silver has obtained a prominence mainly due to the unique optical properties it possesses. Silver nanomaterials have been used in several electrical conductivity applications. Yet, adequate research related to this topic have not been done. Therefore, this study was conducted with the objective of assessing the influence of silver nanomaterial morphology towards their conductive properties in aqueous nanodispersions. According to literature, electrical conductivity of colloidal suspensions containing nanoscale conducting particles is related to the particle volume fraction and the electrical double layer (EDL) thickness. Particle shape can affect this EDL thickness. Thus, electrical conductivity of silver nanoparticles with different shapes and sizes were tested. Silver nanomaterials were synthesized using chemical reduction method and these were characterized using transmission electron microscopy, UV-Visible spectroscopy and dynamic light scattering. Results obtained from characterization confirmed the successful formation of silver nanospheres, nanorods, nanoprisms, nanowires and nanoplates. Electrical conductivity of each of these different nanomaterials was measured under different sizes and concentrations. For comparison of conductivity measurements, standard sodium chloride solution and ultrapure water were used as references. Generally, increasing the particle concentration increased electrical conductivity, regardless of shape or size. In spherical silver nanoparticles, conductivity was shown to be increased with decreasing size. The highest electrical conductivity of aqueous nanodispersion was recorded as 376 $\pm$ 22 µS/cm when silver nanowires (1 - 4 µm) were tested. Conductivity readings of the nanorods (100 - 225 nm), nanoplates (38 $\pm$ 4 nm), and nanoprisms (40 $\pm$ 5 nm) were obtained as 282 $\pm$ 18 µS/cm, 153 $\pm$ 12 µS/cm, 133 $\pm$ 9 µS/cm respectively in aqueous nanodispersions. Therefore, in conclusion, this study claims that there is a relationship between the morphology and electrical conductivity of silver nanomaterial. Further studies should be done to assess the effect of the type of metal towards electrical conductance in the range of nanoscale.

Keywords: silver nanomaterials, electrical conductivity, shape of nanomaterials, size effect

Acknowledgement: This work was supported by the Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayewardenepura.