Synthesis of single crystalline Au and Ag nanorods for plasmonic luminescent devices in PV application

A. Sethi [a,] *, H. Ahmed[a], S. Chandra[a] and S. J. McCormack[a]

[a]Dept. of Civil, Structural and Environmental Engineering. Trinity College Dublin, Dublin, Ireland.

*Corresponding author Email: sethia@tcd.ie Tel: + 353 1 896 2671

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Abstract

Luminescent Solar Concentrators (LSCs)[1] are luminescent devices with the primary goal of the concentration of light to the edge of the device where the solar cells are attached. It has great potential for building integrated PV structures. A Luminescent Downshifting (LDS)[2] layer is an upcoming method to improve the poor spectral response of the solar cells to the short wavelength-light. Plasmonic properties of metal nanoparticles (MNP) such as Gold (Au) and Silver (Ag) nanorods can be used for the enhancement of fluorescence of quantum dots (QDs) and organic dyes in LSC and LDS applications. The spacing between the fluorophore and the MNP dramatically changes the fluorescence rate of the luminescent species and consequently, luminescent quantum yield (LQY), lifetime, and Photoluminescence (PL) intensity. It is important therefore, to find the optimal concentration of the nanorods that gives the maximum fluorescence emission enhancement of the fluorophores. The challenge however has been to disperse the nanorods in an organic solvent that does not alter its optical properties in PMMA and Epoxy resin. MNPs were synthesized using the seed mediated approach using CTAB as the capping agent[3,4] to form the nanorods. Shape separation of the nanorods has been achieved successfully and the dispersion of the nanorods in toluene and ethanol has also been achieved. The optimum concentrations of the luminescent species and MNP were established for LSC and LDS devices. The plasmonic interactions between the luminescent species and Au, Ag nanorods were investigated.

References:

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