Enhancement of Optical and Electrical Properties of silicon Solar Cell Using graded index dual layer Antireflective coating through Aerosol Impact deposition Assembly

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In this research work, a double layer fused silica of graded refractive indices was coated on glass substrates using a novel technique named Aerosol Impact deposition assembly (AIDA) to reduce the Optical losses of Solar Photovoltaics. The said system consist of the gases precursors namely Silane, Oxygen and Helium that ionize in the reaction chamber of AIDA to form silica nanoparticles. The nanoparticles size and shape were controlled by the flowrates of each precursor gas, pressure difference in reaction plus deposition chamber and the amount of inert gas (Helium). These nanoparticles were accelerated towards deposition chamber of the assembly with high impact speed using a small slit nozzle of size 0.5mm where they were coated on a glass substrate placed on a moving stage. The coated film were characterized using scanning electron microscope (SEM), atomic force microscope (AFM) and transmission electron microscope (TEM) to determine the particle size, shape and morphology of the coated film. The average nanoparticle size determined from TEM image was 12.5 nm while the porosity of the top and bottom thin films were 60% and 42% respectively. UV-Spectroscopy results showed that reflection losses was decreased from 9% to 2% in a broad range of wavelength 250-1200 nm. Due to high porosity and enough roughness, the coated thin film showed excellent self-cleaning property with water contact angle more than 160^{o}. Moreover, electrical efficiency of the Solar cell was increased 0.3% of the uncoated front glass while Short current Density (Jsc) of the cell was increased as much as 1.5 mA/cm^2 from 39.1 mA/cm^2 to 40.6 mA/cm^2.

References

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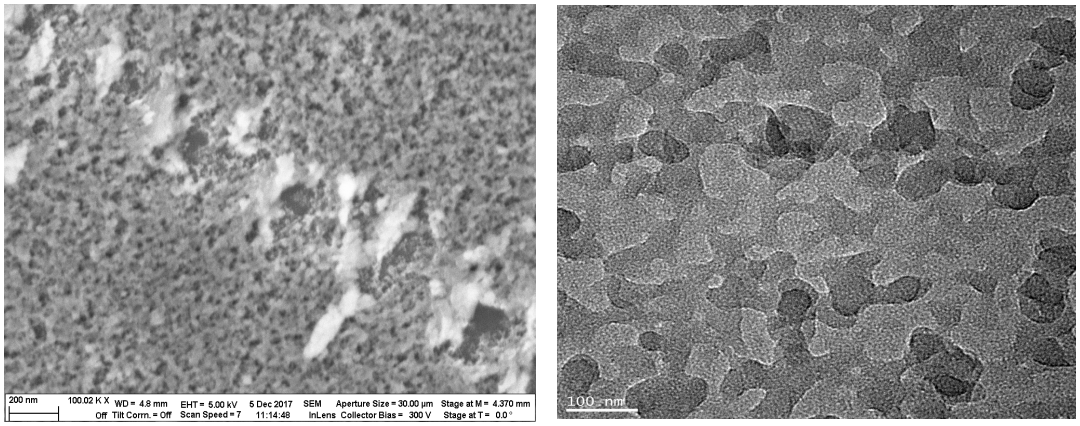


Fig 1. Shows the morphology of surface by SEM image at the left side and TEM image at the right side.

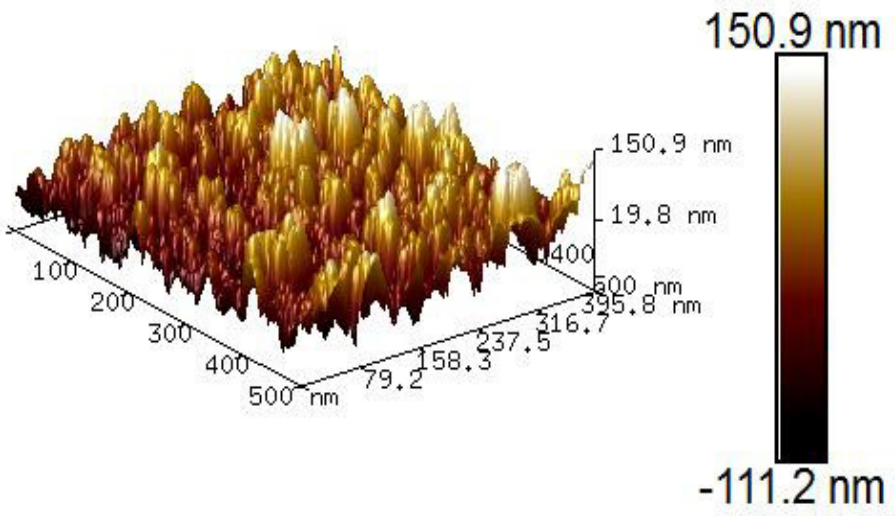


Fig 2. AFM image showing the surface topology of the coatings.

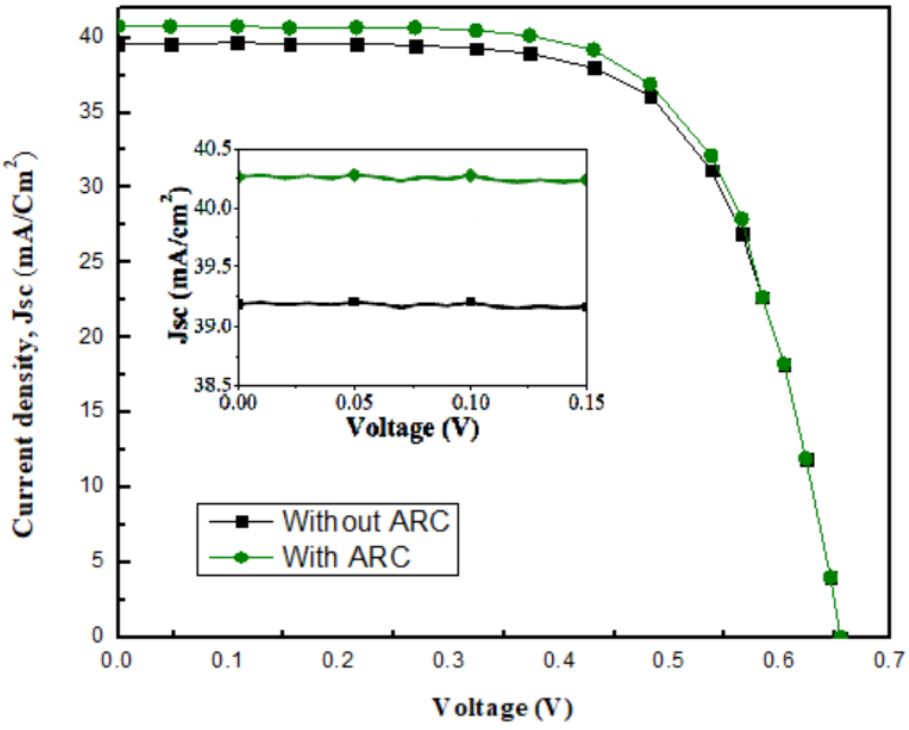


Fig 3. Showing IV curve of Coatings.