# SELECTIVE ABSORBERS BASED ON CARBON NANOTUBE COATING FROM ELECTROPHORETIC DEPOSITION

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The production of hot water using efficient photothermal solar cells has received special interest due to global warming and the negative impact of fossil fuels on the environment. The basic principle of solar thermal conversion is transforming solar energy into caloric energy by heating a transfer fluid through an absorber. To minimize optical losses, selective absorbers are required to have high absorptivity over the spectral range of solar emission (0.5-2 μm) and low emittance in the mid and far-infrared spectral regions (2-20μm) [1] [2] [3]. In this way, this work deals with the application of carbon nanotubes (CNTs), deposited by anodic electrophoretic deposition (EPD), as selective solar absorbers in a tandem type photo-thermal solar cell. Different kinds of CNTs with different ratio aspects, such as single wall (SW) and multi wall (MW), were dispersed by ultrasound in an aqueous solution of pyrocatechol violet (PV). PV couples to the CNT's outer walls via $\pi$-$\pi$ stacking interactions and acts as a dispersing agent as well as charging agent. Zeta potentials, up to -40 mV, were obtained for the dispersed CNTs, and thereafter CNT's films were deposited on platinized silicon wafers by EPD. Tandem absorbers are obtained by varying different EPD parameters in order to control the final thickness film, the density, and also the morphology, which are the crucial keys to tune and optimize the final optical properties. AFM images were logged to characterize the surface of the coatings, SEM micrographs were recorded in order to visualize the morphology and measure the film thickness and the density was obtained from X-Ray reflectivity (XRR) measurements. The hemispherical reflectance R of the samples was measured by spectrophotometer equipped with an integrating sphere, and next the absorptance ($\alpha$) and emittance ($\varepsilon$) were calculated from the reflectance spectra. The selectivity of the deposits, based on $\alpha$ and $\varepsilon$ values, is then discussed according to the applied electric field and the coating thickness. The samples obtained using SWCNT had better selectivity as MWCNT and the experimental results show that it was possible to obtain values of solar absorptance of 0.91 and thermal emission of 0.05. Thermal annealing has revealed that the best coatings could withstand up to 300°C while sustaining selective properties highlighting their application potential for mid-range temperature devices.

[1] S. Shehayeb, X. Deschanels, I. Karamé, L. Ghannam, G. Toquer
Spectrally selective coatings obtained from electrophoretic deposition of CuO nanoparticles
Surface & Coatings Technology, 322, 38-45, 2017

[2] S. Shehayeb, X. Deschanels, J. Lautru, L. Ghannam, M. Odorico, I. Karamé, G. Toquer
Thin polymeric CuO film from EPD designed for low temperature photothermal absorbers
Electrochimica Acta, 305, 295-303, 2019

[3] S. Shehayeb, X. Deschanels, L. Ghannam, I. Karamé, G. Toquer
Tandem selective photothermal absorbers based on EPD of CuO colloidal suspension coupled with dip-coated silica
Surface & Coatings Technology, 408, 126818, 2021