FABRICATION OF OCTAHEDRAL TANTALUM CLUSTER FILM BY ELECTROPHORETIC DEPOSITION

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The octahedral $Ta_6Br_{14}.8H_2O$ cluster, one of the $[M_6L^i_{12}L^a_6]^{n-}$ octahedrons (M= Nb, Ta; L^i= halogen, L^a= halogen or chalcogen), exhibits interesting oxido-reduction properties in solution[1]. The application of the $[Ta_6Br^i_{12}]^{2+}$ cores has been potentially studied in biotechnologies[2], optical devices[3], photovoltaic cells[4] and catalysis[5]. Originating from the expectation to block the UV and NIR light on low-emissivity window, the $Ta_6Br_{14}.8H_2O$ cluster thin film on ITO glass has been fabricated by electrophoretic deposition (EPD) process, a fairly rapid and low cost two-step process well-known for ceramic shaping, conductive surface coating and easily scalable to industrial level. The interesting characteristic has been recognized that the green $[Ta_6Br^i_{12}]^{2+}$ cores (adsorbing Ultra-Visible range) easily transfers to brown $[Ta_6Br^i_{12}]^{3+/4+}$ cores (absorbing near-infrared range) when dissolved in different solvents. Therefore, selecting the medium and optimizing the concentration of water in solvent to obtain the green homogeneous suspension with high dissolution is the main purpose of study. Considering the green color and transmittance of solution, as well as FE-SEM surface morphology of the green film, 0.02 mL H_2O per mL acetone was selected as the optimal ratio to obtain the green transparent suspension and possibility to fabricate the green film by EPD process. However, the $[Ta_6Br^i_{12}]^{2+}$ green film has been essentially incorporated with poly vinyl pyrrolidone (PVP) in order to improve the dispersion of $Ta_6Br_{14}.8H_2O$ clusters inside the suspension and effectively prevent the performance of new $[Ta_6Br^i_{12}]^{3+/4+}$ clusters (brown-color) by oxidizing reactions.

Reference

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