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## Structural and Photoluminescent Properties of a Composite Tantalum Oxide and Silicon Nanocrystals Embedded in a Silicon Oxide Film

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### Abstract

Tantalum oxide crystals encrusted in a silicon oxide matrix were synthesized by using a hot filament chemical vapor deposition system (HFCVD). A solid source composed by a mixture in different percentages of Ta<sub>2</sub>O<sub>5</sub> and silicon (Si) powders were used as reactants. The films were grown at 800 °C and 1000 °C under hydrogen ambient. The deposited films were characterized by X-ray photoelectron spectroscopy (XPS), high-resolution transmission electron microscopy (HRTEM) and photoluminescence (PL) at room temperature. From the XPS results it was confirmed the formation of a mixture of Tantalum oxide, silicon oxide and Si nanoparticles (Ta<sub>2</sub>O<sub>5</sub>.SiO<sub>2</sub>-Si(nc)) as seen from the Si (2p) and Ta (4f) lines corresponding to Si<sup>+</sup> and Ta<sup>+</sup> states respectively. Ta<sub>2</sub>O<sub>5</sub> and Si nanocrystals (Si-NCs) embedded in the silicon oxide films were observed on HRTEM images which corroborate the XPS results. Finally the emission properties of the films exhibited a broad band from 400 to 850 nm caused by the independent PL properties of tantalum oxide and Si-NCs that compose the film. The intensity of the emissions was observed to be dependent on both temperature of deposition and the ratio Ta<sub>2</sub>O<sub>5</sub>/Si, used as initial reactants. Results from this work might supply useful data for the development of future light emitter devices.

**Keywords:** Composites, Tantalum Oxide, Silicon Nanocrystals, Silicon Oxide.

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