Synthesis and luminescent properties of aluminium oxide-titanium dioxide nanocomposites doped with different rare-earths ions.

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To minimize the cost of harvesting shorter-energy photons from the solar spectrum or how to improve the efficiency of solar cells has been a challenge for the past years. Therefore, the application of the luminescent up-conversion (UC) nano-materials has been proposed as efficient methods for enhancing the poor spectral response of solar cells in an infrared (IR) region particularly for dye sensitized solar cells (DSSCs), silicon (Si) solar cells and organic solar cells. The poor spectral response is due to transmission of photons with energy lower than the bandgap not being absorbed. Therefore, transmission losses contribute more to the losses for wider bandgap solar cells. This study was conducted to investigate the UC luminescence properties of Al_2O_3-TiO_2 nano-composites doped with different rare-earths (RE) such as ytterbium (Yb^{3+}), erbium (Er^{3+}) and thulium (Tm^{3+}). These UC luminescence properties display potential applications in solar cells. This work was proposed because transmission is a major problem in solar cells as a result of lower-energy photon than energy bandgap.

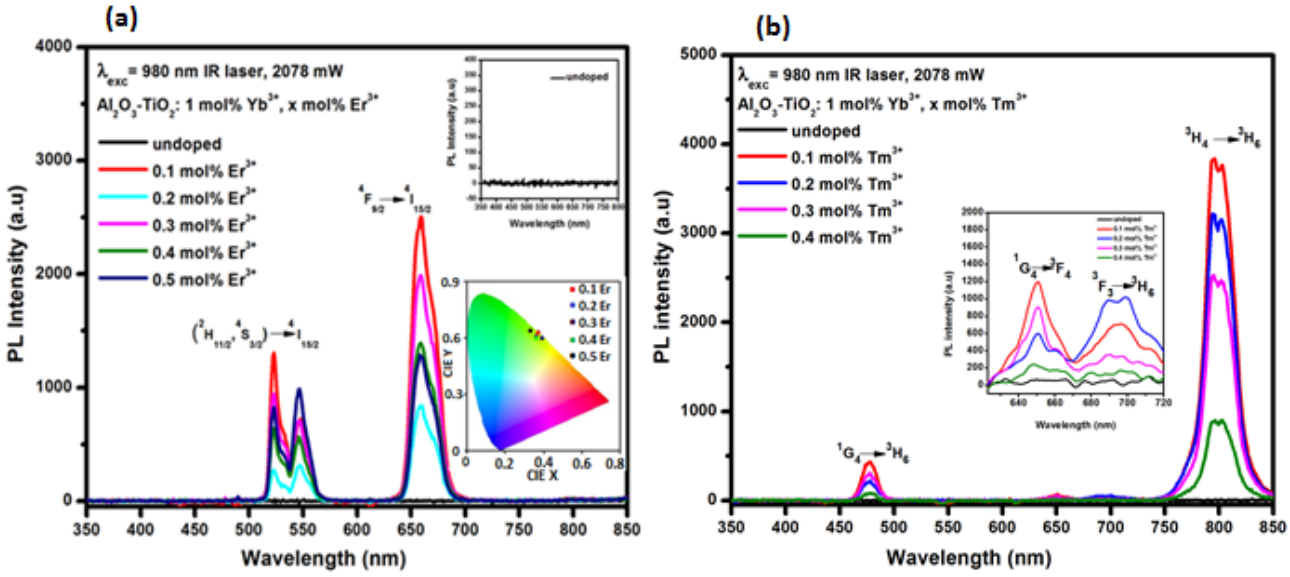

Figure 1: Up-conversion spectra of nanocomposites (a) Al_2O_3-TiO_2: Yb^{3+}, Er^{3+} and (b) Al_2O_3-TiO_2: Yb^{3+}, Tm^{3+} powders by excitation of 980 nm.