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OPTICAL SPECTROSCOPY STUDIES OF NEW INORGANIC $K_2Bi_{0.8}Yb_{0.2}(PO_4)(MoO_4)$ DOPED WITH Er^{3+} PHOSPHORS

OPTICAL PROPERTIES

Upconversion

The absorption of two or more photons leading to the emission of light at a wavelength shorter than the excitation wavelength is described as the upconversion (UC) process. UC materials possess many optical features and these materials are widely used in many devices such as solid-state lasers, temperature sensors, optical fibers or displays technologies

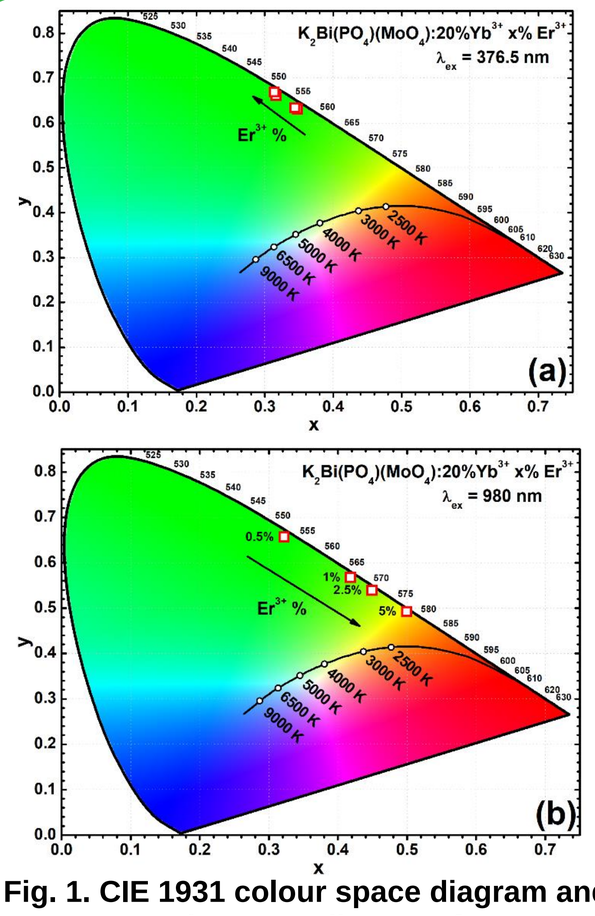


Fig. 1. CIE 1931 colour space diagram and colour coordinates of $K_2Bi(PO_4)(MoO_4)$:20% Yb^{3+} phosphors as a function of Er^{3+} concentration (a) λ_{ex} = 376.5 nm and (b) λ_{ex} = 980 nm

INTRO

Inorganic host matrixes embedded with ladder like lanthanide ions with metastable 4f energy levels are crucial components of generating higher energy photons. Since one UC system can be analyzed as a performance of multiple mechanisms, it becomes difficult to quantitatively evaluate the involved processes. Several main mechanisms representation is depicted in Fig. 1.

SEM

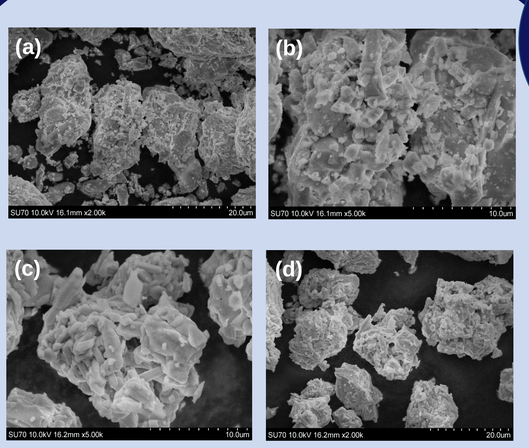
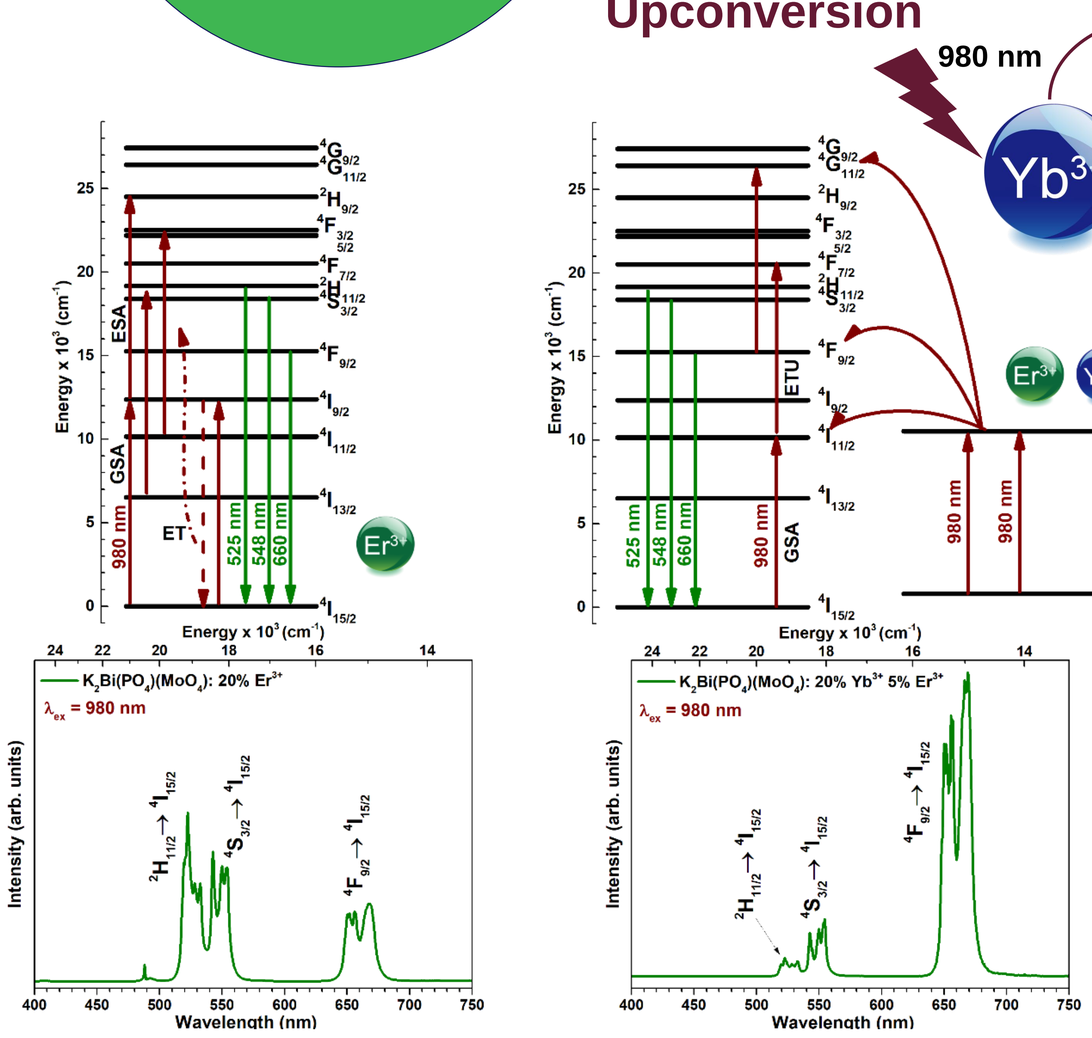


Fig. 2. SEM images of (a) and (b) $K_2Bi(PO_4)(MoO_4)$:20%Yb^{3+} (c) and (d) $K_2Bi(PO_4)(MoO_4)$:20%Yb^{3+}20% Er^{3+} powders.

Upconversion



Downconversion

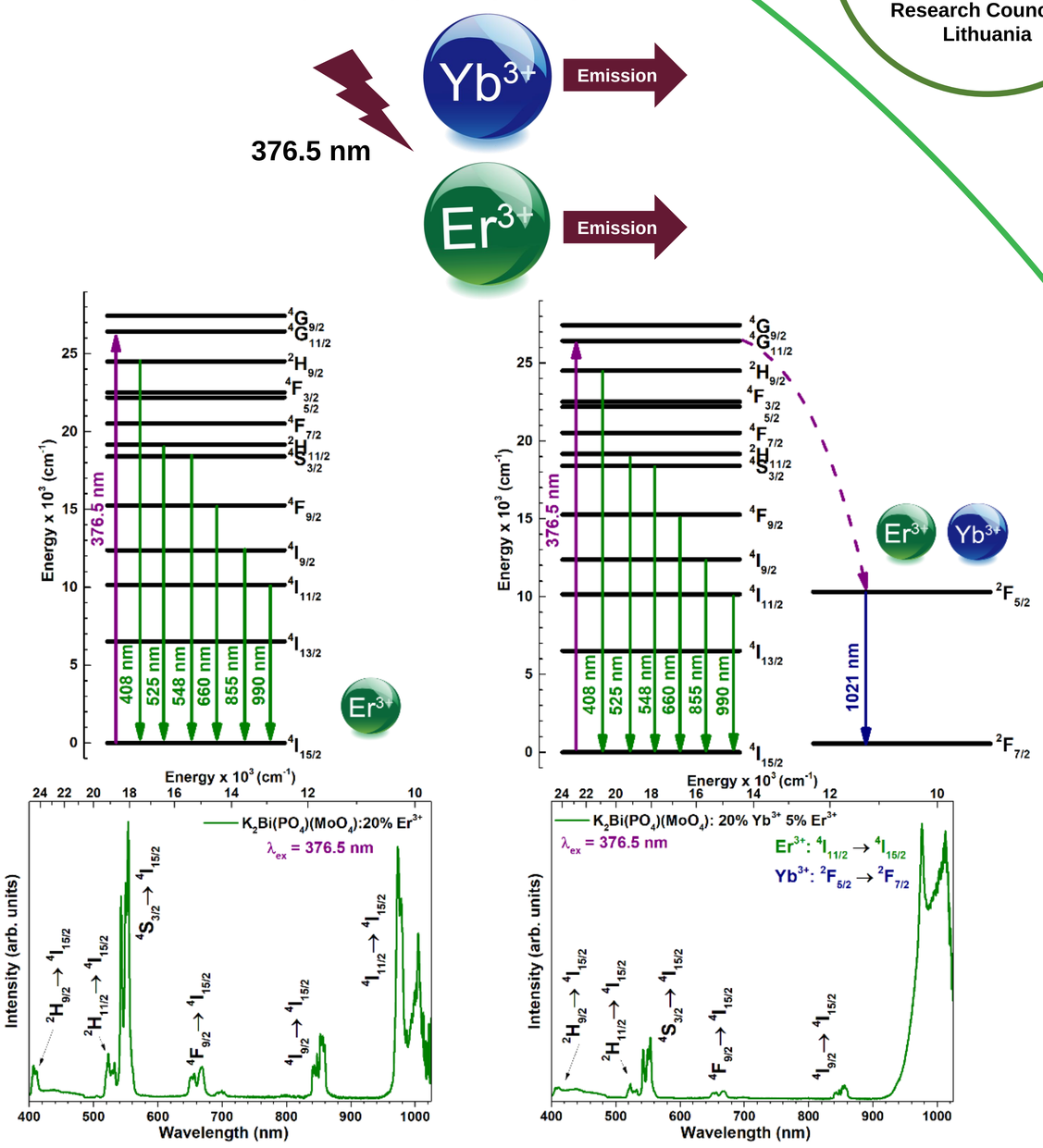


Fig. 3. Upconversion emission of $K_2Bi(PO_4)(MoO_4)$:20% Er^{3+} and $K_2Bi(PO_4)(MoO_4)$:20%Yb^{3+} 5% Er^{3+}.

Fig. 4. Downconversion emission of $K_2Bi(PO_4)(MoO_4)$:20% Er^{3+} and $K_2Bi(PO_4)(MoO_4)$:20%Yb^{3+} 5% Er^{3+}.

A series of upconverting materials $K_2Yb_{0.2}Bi_{0.8-x}(PO_4)(MoO_4)$ doped with x Er^{3+} ions was synthesized by solid state reaction method. All of the synthesized materials have shown similar emission spectra except different intensity. The most intense peaks are centered in the green spectral region and can be attributed to the $^2H_{11/2} \rightarrow {}^4I_{15/2}$ and $^4S_{3/2} \rightarrow {}^4I_{15/2}$ transitions under 376.5 nm excitation, while synthesized materials show different features under 980 nm laser excitation. The most intense sample was doped with 5% Er^{3+} and the main emission peaks are centered in the orange-red region. These peaks can be attributed to the $^4F_{9/2} \rightarrow {}^4I_{15/2}$ transitions of Er^{3+} ions.

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