

The study of pH influence on structural and spectroscopic properties of nanocrystalline Eu^{3+} ion doped yttrium orthovanadate

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Abstract

This paper presents an evolution of size and morphology of yttrium orthovanadate, influenced by pH conditions during the synthesis. A thorough research of the spectroscopic properties has been performed. Series of highly crystalline 1 mol% $\text{Eu}^{3+}:\text{YVO}_4$ has been synthesized using the co-precipitation method. Additionally, to improve the crystallinity materials have been heat-treated at 800 °C. The structural and morphological properties of the particles were studied using XRD (X-ray powder diffraction) and SEM (Scanning Electron Microscopy) techniques.

In order to investigate spectroscopic properties of 1 mol% $\text{Eu}^{3+}:\text{YVO}_4$, emission spectra and luminescence kinetics were measured. It has been found that alkaline pH manifests in smaller particles in comparison to acidic pH conditions. Additionally, superior spectroscopic properties present materials obtained also in alkaline pH.

Keywords: *Yttrium orthovanadate; Nanocrystallites; Evolution of pH dependence; Luminescence properties; Eu^{3+} ion doping*

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In Figures S1-S4 are presented the size distribution analysis of the materials obtained at different pH. Synthesis in acidic and neutral pH results in bigger particles than in case of alkaline pH. Additionally, for the acidic and neutral pH more widespread distribution of sizes is observed, ranging from 100 nm to 2 μm . For the material obtained in alkaline pH (11) size distribution is narrower and ranges from 40 to 240 nm. Also, for alkaline and acidic pH thresholds particles present elongated shapes, and for neutral pH particles are more squared. There is also a linear dependence of width and length with changing size within one material.

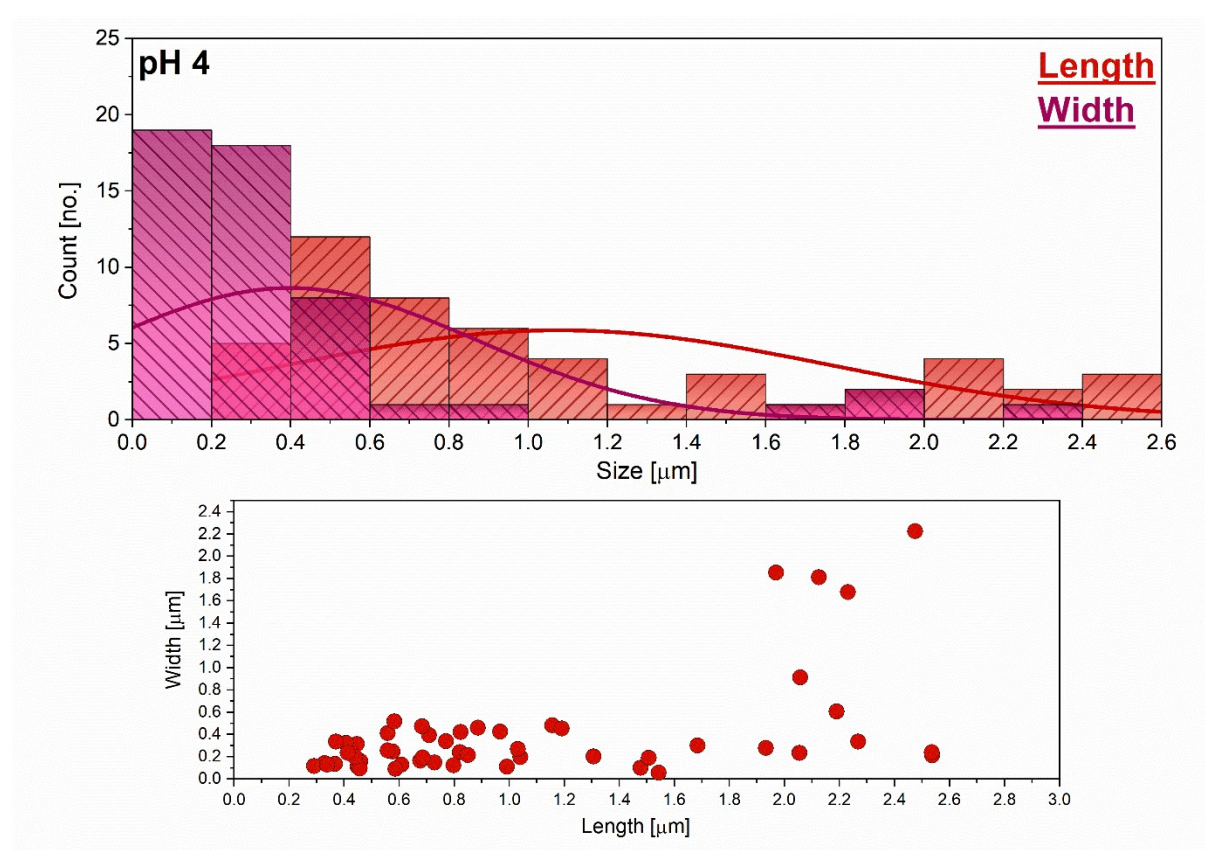


Figure S1. Size distribution analysis based on SEM images of 1 mol% $\text{Eu}^{3+}:\text{YVO}_4$ obtained at pH 4.

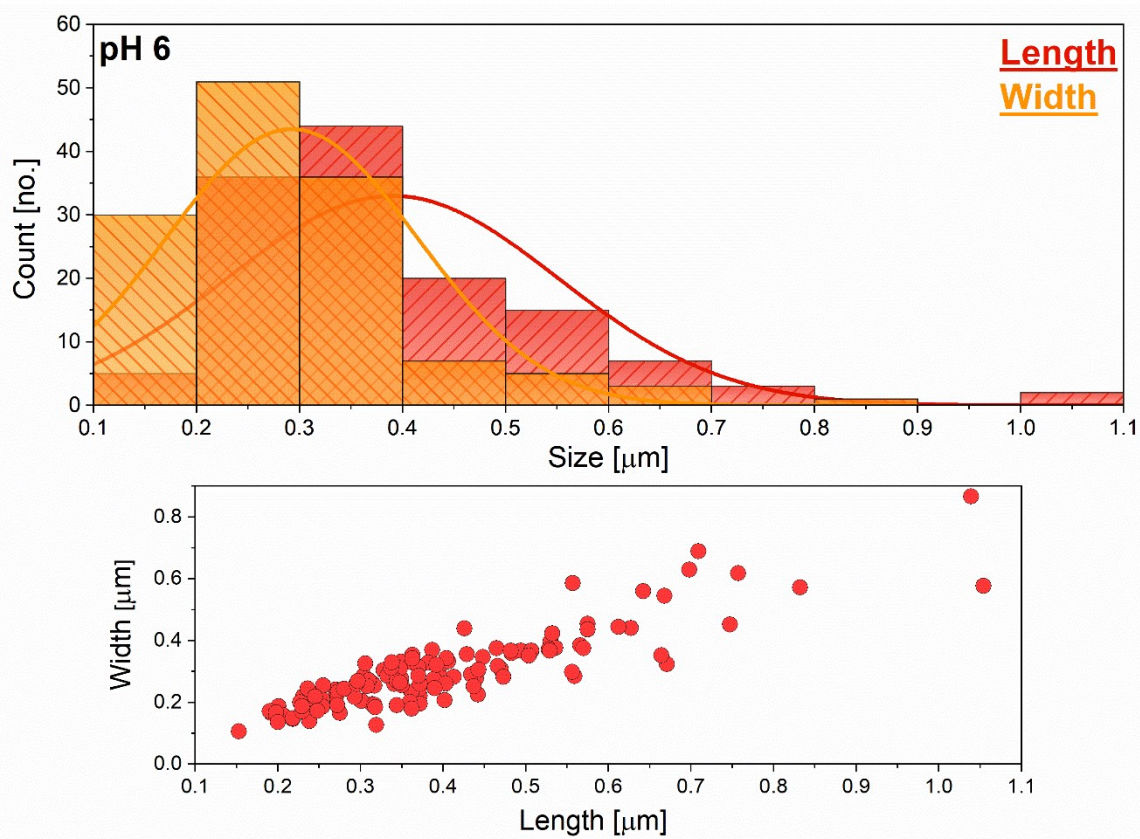


Figure S2. Size distribution analysis based on SEM images of 1 mol% $\text{Eu}^{3+}:\text{YVO}_4$ obtained at pH 6.

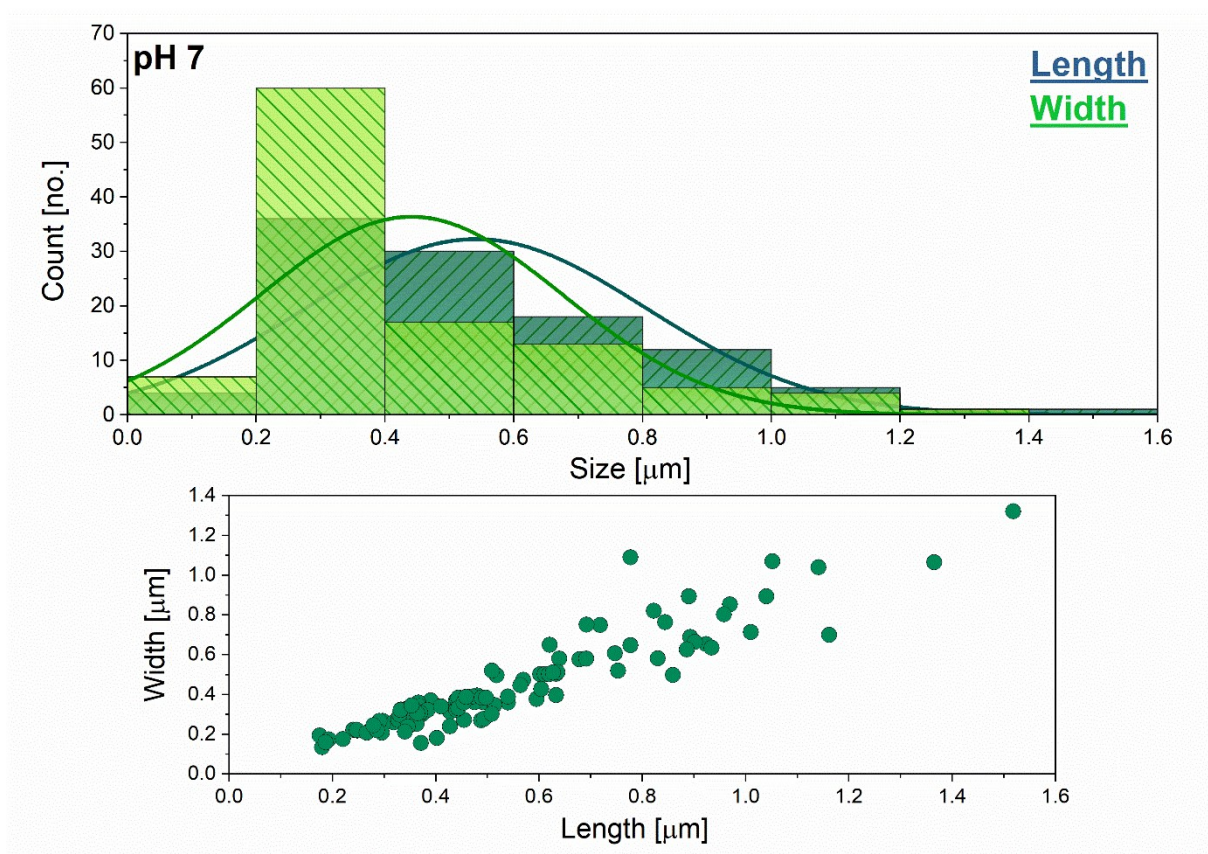


Figure S3. Size distribution analysis based on SEM images of 1 mol% $\text{Eu}^{3+}:\text{YVO}_4$ obtained at pH 7.

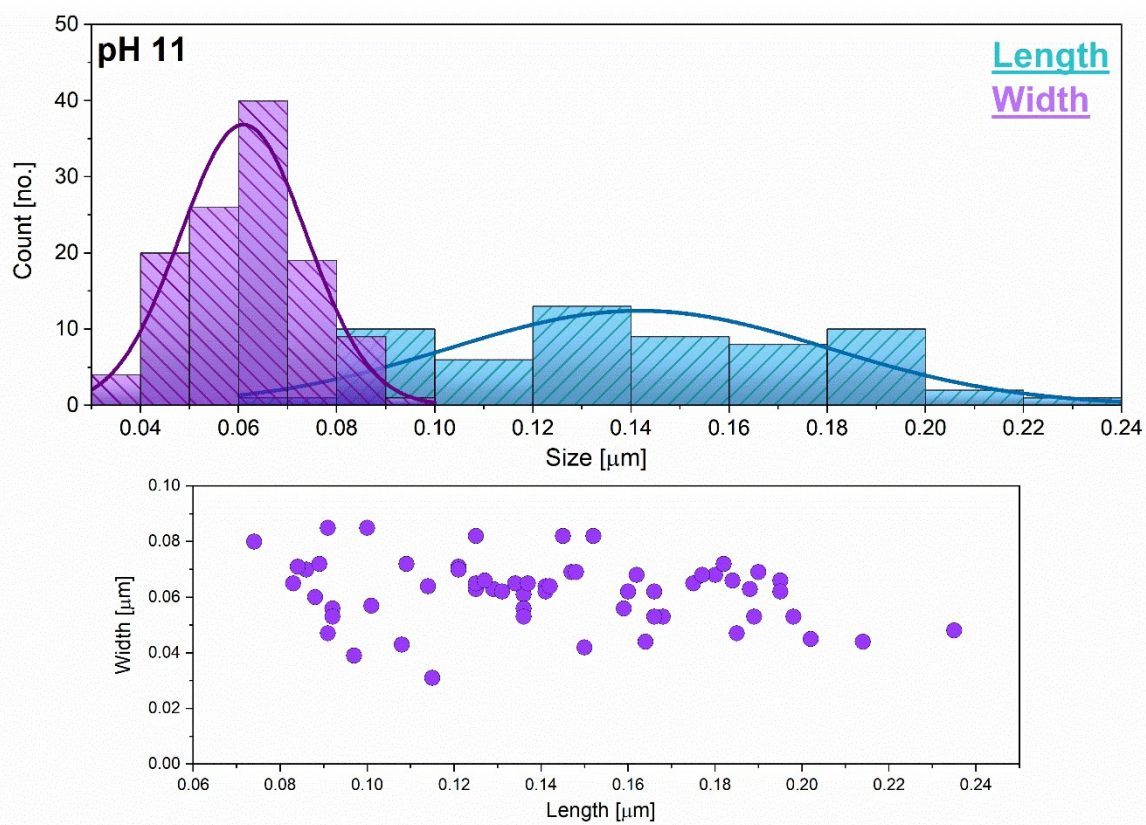


Figure S4. Size distribution analysis based on SEM images of 1 mol% $\text{Eu}^{3+}:\text{YVO}_4$ obtained at pH 11.