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ADVANCED CERAMICS AND APPLICATION III
New Frontiers in Multifunctional Material Science and Processing

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Surfactants Assisted Hydrothermal Synthesis of NaYF₄ co-doped Yb³⁺/Er³⁺ Up-conversion Nanoparticles

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In the past few years there is a great interest for synthesis of the surface modified up-conversion nanoparticles that can be used for biomedical application such as bio-detection, fluorescence imaging and drug delivery. Thanks to their enhanced tissue penetration depth, improved stability against photo-bleaching and low cytotoxicity Ln-doped fluorides have been recognized as novel near-infrared fluorophores. Among them, NaYF₄ is considered to be one of the most efficient low phonon energy host for Ln-ions doping, particularly its hexagonal form which poses multisite character of the crystal lattice. In this work NaYF₄ nanoparticles co-doped with Yb³⁺ and Er³⁺ were synthesized using the hydrothermal method at 200 °C (3h) in the presence of polyvinylpyrrolidone (PVP) and polyethylene glycol (PEG), used as surfactants and structure directing agents also. Obtained particles were analyzed by X-ray powder diffractometry (XRPD), Fourier transform infrared spectroscopy (FTIR) and scanning/transmission electron microscopy (SEM/TEM). It was shown that addition of PVP enhance the crystallization of hexagonal NaYF₄:Yb³⁺, Er³⁺ phase which provide more intense green emission CIE (0.31, 0.66), assigned to the Er³⁺ (²H_{11/2}, ⁴S_{3/2}) → ⁴I_{15/2} electronic transitions, after been excited with infrared light (λ=978 nm).