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Room temperature synthesis and luminescence of β-$NaGdF_4$: Eu^{3+}, Er^{3+}, and Yb^{3+}, Er^{3+} nanocrystals

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Phase pure hexagonal β-$NaGdF_4$: Eu^{3+}, Er^{3+} samples of less than 10 nm particle size were synthesized in ethylene glycol within 24 hours at room temperature. The materials were characterized by powder X-ray diffraction, electron microscopy, and luminescence spectroscopy. The luminescence and energy transfer between Gd^{3+}, Eu^{3+}, and Er^{3+} ions were investigated upon UV excitation.

β-$NaGdF_4$: Yb^{3+}, Er^{3+} nanoparticles were prepared by microwave heating in ethylene glycol and ionic liquid mixtures. The synthesis was optimized for green Er^{3+} upconversion emission under 970 nm excitation. Solvent composition, water content, core/shell structure, and reaction temperature were identified as key parameters for material synthesis. 10 nm core/shell particles achieved more than 1/1000 of bulk material upconversion intensity, see the Figure.