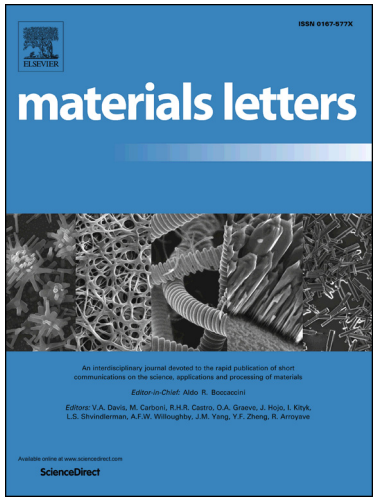

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Phase evolution and upconversion luminescence enhancement investigation from YF_3 to (α+β)-$NaYF_4$ by doping of Cu^{2+} ion

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ABSTRACT: A facile, but effective, method has been developed for enhancing the upconversion (UC) luminescence efficiency of YF_3: Yb^{3+}, Er^{3+} microcrystals through doping of Cu^{2+} ion, accompanied by phase transformation from YF_3 to α-$NaYF_4$ to (α+β)-$NaYF_4$. The Cu^{2+} ion occupies the Y^{3+} ion crystal lattice site leading to positive vacancy and lower energy barrier in the reaction of forming α-$NaYF_4$. In addition, we have also systematically investigated the phase transformation from YF_3 to (α+β)-$NaYF_4$. With the extension of the reaction time, surface energy of the $[10\bar{1}0]$ crystal plane decreases dramatically while that of the [0001] crystal plane increases accordingly, which may be the main reason for forming (α+β)-$NaYF_4$. This synthesis strategy enables UC luminescence enhancement and simultaneous crystal phase transformation, which should inspire more even wider application of other UC host materials.

Keywords: Upconversion luminescence, Phase transformation, YF_3, $NaYF_4$, Cu^{2+} ion doping