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Spectroscopic Imaging of NIR to Visible Upconversion from $NaYF_4$: Yb^{3+}, Er^{3+} Nanoparticles on Au Nano-cavity Arrays[1] JON FISHER, South Dakota School of Mines and Technology, BO ZHAO, CUIKUN LIN, MARY BERRY, P. STANLEY MAY, University of South Dakota, STEVE SMITH, South Dakota School of Mines and Technology — We use spectroscopic imaging to assess the spatial variations in upconversion luminescence from $NaYF_4$:Er^{3+},Yb^{3+} nanoparticles embedded in PMMA on Au nano-cavity arrays. The nano-cavity arrays support a surface plasmon (SP) resonance at 980nm, coincident with the peak absorption of the Yb^{3+} sensitizer. Spatially-resolved upconversion spectra show a 30X to 3X luminescence intensity enhancement on the nano-cavity array compared to the nearby smooth Au surface, corresponding to excitation intensities from 1 W/cm^2 to 300kW/cm^2. Our analysis shows the power dependent enhancement in upconversion luminescence can be almost entirely accounted for by a constant shift in the effective excitation intensity, which is maintained over five orders of magnitude variation in excitation intensity. The variations in upconversion luminescence enhancement with power are modeled by a 3-level-system near the saturation limit, and by simultaneous solution of a system of coupled nonlinear differential equations, both analyses agree well with the experiments. Analysis of the statistical distribution of emission intensities in the spectroscopic images on and off the nano-cavity arrays provides an estimate of the average enhancement factor independent of fluctuations in nano-particle density.

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