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Two-color Surface Plasmon Polariton Assisted Upconversion Luminescence in $NaYF_4$:Yb:Tm on Au Nanopillar Arrays STEVE SMITH, ROBERT ANDERSON, AMY HOR, JON FISHER, South Dakota School of Mines and Technology, KHADIJEH BAYAT, MAHDI BAROUGHI, South Dakota State University, QUOCAHN LU, P. STANELY MAY, University of South Dakota — Spectroscopic imaging was used to study the surface plasmon polariton (SPP) enhanced upconversion luminescence of $NaYF_4$:Tm:Yb nanoparticles embedded in PMMA supported on Au nanopillar arrays. Spatially-resolved upconversion spectra show enhancement in both the visible and near-infrared region of the spectrum, clearly associated with the plasmonic resonances of an engineered periodic array of nanopillars. The array has a lattice resonance associated with the SPP near 980nm, at the peak absorption of the Yb^{3+} ion, while the local surface plasmon resonance (LSPR) of the individual pillars is seen to enhance the near-infrared emission of Tm^{3+} near 800nm. The combined effect results in a significantly higher enhancement of the near-infrared emission when compared to the visible upconversion lines of Tm^{3+}, consistent with the interpretation of sequential surface plasmon assisted absorption and emission at two separate and disparate energies. The presence of SPP and LSPR were confirmed by spectrally resolved reflectivity, and the mechanism for luminescence enhancement was investigated by time resolved measurements of the luminescence decay. Reflectivity measurements are compared to finite difference time domain simulations (FDTD).

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