

2011 Materials Research Society Fall Meeting
November 28 – December 2, 2011,
Boston Massachusetts USA
SESSION CC13: Functional Semiconductor Nanocrystals and Metal-Hybrid Structures
Thursday Evening, December 1, 2011
8:00 PM
Exhibition Hall D (Hynes)

8:00 PM CC13.11

Embedded Nanoscale Metamaterial for Enhanced Optical Absorption in Ultrathin Silicon
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A nanoscale metallic metamaterial embedded into an ultrathin silicon film is shown to substantially increase optical absorption. Computer simulations on 20 nm-thick metal patterns embedded in ~80 nm-thick amorphous silicon films find more than 100% increase in integrated absorption in the visible regime (400-800 nm), the majority of which occurs in the red/NIR. In experiments on samples with these same thicknesses, we find ~50% increase in wavelength-integrated absorption. These results may prove useful in thin film, and especially ultrathin film, photovoltaics. Computer simulations are done with varied embedding depth, film thicknesses, and metamaterial shapes and patterns in efforts to optimize absorption. Moreover, different metals are employed in both simulations and experiment to obtain information on whether and to what extent (if any) plasmonic effects contribute to the observed effects.