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**Switchable vanadium dioxide (VO2) metamaterials fabricated from tungsten doped vanadia-based colloidal nanocrystals**[1] TAEJONG PAIK, SUNG-HOON HONG, THOMAS GORDON, ASHLEY GAULDING, CHERIE KAGAN, CHRISTOPHER MURRAY, University of Pennsylvania — We report the fabrication of thermochromic VO2-based metamaterials using solution-processable colloidal nanocrystals. Vanadium-based nanoparticles are prepared through a non-hydrolytic reaction, resulting in stable colloidal dispersions in solution. Thermochromic nanocrystalline VO2 thin-films are prepared via rapid thermal annealing of colloidal nanoparticles coated on a variety of substrates. Nanostructured VO2 can be patterned over large areas by nanoimprint lithography. Precise control of tungsten (W) doping concentration in colloidal nanoparticles enables tuning of the phase transition temperature of the nanocrystalline VO2 thin-films. W-doped VO2 films display a sharp temperature dependent phase transition, similar to the undoped VO2 film, but at lower temperatures tunable with the doping level. By sequential coating of doped VO2 with different doping concentrations, we fabricate ?smart? multi-layered VO2 films displaying multiple phase transition temperatures within a single structure, allowing for dynamic modulation of the metal-dielectric layered structure. The optical properties programmed into the layered structure are switchable with temperature, which provides additional degrees of freedom to design tunable optical metamaterials.

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