Optical switching in nanostructured phase-change materials

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The chalcogenides are a unique material family, variously offering high-index dielectric, plasmonic, 'epsilon-near-zero' (ENZ) and topological insulator properties when their constituent elements are combined in appropriate proportions. They present a flexible, CMOS-compatible material base for nanophotonics, with compositionally-controlled optical properties and a capacity for fast, non-volatile, electrically-/optically-induced switching between amorphous and crystalline phase states with markedly different properties (refractive index, resistivity, etc.). We present recent developments in their application to the engineering of switchable all-dielectric near-infrared metamaterials, switchably-plasmonic UV-visible metasurfaces, and ENZ metamaterials.