

Sculptured Thin Films

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Sculptured thin films (STFs) are nanoengineered materials with columnar morphology tailored to elicit desired optical responses upon excitation. The identical nanowires comprising a STF are oriented (nominally) parallel to each other, and possess two- and/or three-dimensional shapes. Two canonical forms of STFs have been formalized. Linear constitutive relations for general STFs as unidirectionally non homogeneous (continuously or piecewise uniformly) and locally bi-anisotropic continua are presented, along with a 4x4 matrix ordinary differential equation for wave propagation therein. A nominal model for the macroscopic properties of linear STFs has been devised from using local homogenization. Advanced applications of STFs mostly include optical polarizers and filters. Emerging applications include STF light emitters, STFs with optical gain, electrically controlled STFs, and bioscaffolds. Two other emerging directions are the deposition of polymeric STFs by replamineform, multibeam lithographic, and mixed vapor deposition techniques, as well as the deposition of STFs on topographic substrates to blend the nanoscale and the microscale.