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Crystal growth-based methods used for manufacturing volumetric novel photonic materials as plasmonic nanomaterials and metamaterials

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We report on developments of fabricating nano and micro-structured volumetric plasmonic materials, metamaterials and other materials with unusual electromagnetic properties, utilizing crystal growth techniques based on directional solidification and crystallization. Two types of materials will be discussed: (i) based on directional solidification of eutectic composites, and (ii) directional solidification of dielectrics directly doped with functional nanoparticles of various size, shape and chemical composition (metallic-plasmonic, quantum dots) as well as various additional elements as rare earths, obtained by the nanoparticles direct doping (NPDD). It has been shown that with self-organization mechanism during the eutectic crystallization various shapes pertinent to metamaterials can be obtained as the 'split-ring resonator' geometry, rodlike or lamellar structures which can be used as hyperbolic metamaterials, or for subwavlength transmission of electromagnetic waves, eutectic-based tunable nanoplasmonic materials have been demonstrated for the first time, as well as enhanced second harmonic generation, strongly enhanced Faraday effect and others.

Biography

D A Pawlak is a Professor at the Institute of Electronic Materials Technology (ITME) of Warsaw, and at the Centre of New Technologies (CeNT), University of Warsaw in Poland. She is currently the Head of the Department of Functional Materials at ITME and Leader of the Laboratory of Materials Technology at CeNT. Her research is linked to technology development for the manufacturing of new functional materials, such as plasmonic materials, metamaterials, materials with special electromagnetic properties and materials for solar energy conversion. She currently focuses on bottom-up methods such as directional solidification and crystallization, nanoparticles direct doping method and associated research.

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