

5th International Conference and Exhibition on

LASERS, OPTICS & PHOTONICS

November 28-30, 2016 Atlanta, USA



Dorota A Pawlak

Institute of Electronic Materials Technology, Poland

Plasmonic materials/metamaterials by crystal growth

Professor Jan Czochralski investigated the crystallization velocity of metals from the melt, for this he developed a crystallization method in 1916, published in 1918, which later has been used by Teal and Little in Bell Laboratories to grow first germanium crystal. This good quality crystal enabled formation of first p-n junction and design of the first point-contact transistor. J Bardeen, W H Brattain and W B Shockley for the discovery got the Nobel Prize in physics in 1956. Currently, the Czochralski method is the most widely used crystal growth technique and Czochralski is often called the father of electronics. Recently it has been proposed to utilize crystal growth methods for manufacturing of novel photonic materials including plasmonic materials and metamaterials. Utilizing eutectic directional solidification such pivotal for metamaterials structures were demonstrated as split-ring resonators. Nanoplasmonic materials with tunable localized surface plasmon resonance and enhanced photoluminescence were demonstrated with an example of Bi_2O_3 -Ag eutectic. Typical for eutectics geometry is lamellar or rod-like, and in this type of structures subwavelength transmission has been demonstrated, and hyperbolic dispersion predicted. Even growth of lamellar eutectics with a rounded structure has been demonstrated resembling the metamaterial hyperlens. Recently, a new approach demonstrated combining the eutectic crystallization with photonic crystal templates, thus enabling a two orders of-structuring of the material. Also, directional solidification has been applied for a novel method of manufacturing dielectric bulk materials doped with various nanoparticles called nanoparticle direct doping. With this method nanoparticles enter the dielectric matrix without a chemical reaction, thus the method enables doping the matrices with nanoparticles or various chemical composition, nanoparticles with specific shape, as well as co-doping with other chemical elements i.e. as rare earth ions. Utilizing crystal growth application for manufacturing of novel photonic composites may enable their easy application.

Biography

Dorota 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.

Dorota.Anna.Pawlak@gmail.com