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Low index optical materials

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This presentation focuses on man-made composites or meta-materials which exploit resonant behaviour in their constituent elements or meta-atoms to reduce the overall refractive index. We illustrate the potential use of such materials as index values drop below unity and approach zero in various applications as well as their use as a possible ink for nano-printing which is one of our motivations. We have investigated distributions of nanoparticles of various sizes and concentrations made from transparent conducting oxides. Their scattering and coupling interactions provide an enhanced or resonant response that can lower the index of the bulk material. These interactions are not included in traditional effective medium models which typically underestimate the actual index values. Our particles of choice are aluminium-doped zinc oxide which can be grown with known concentrations of Al in order to control their plasma frequency or permittivity zero-crossing. Their sizes and concentrations can also be controlled. The polarization dependence of these media has been investigated and will be reported here. Also new simulations and experimental results will be shown.

Biography

Michael A Fiddy received his PhD from the University of London and was Faculty Member at Kings College from 1979-1987. He moved to the University of Massachusetts Lowell in 1987, where he was ECE Department Head from 1994 until 2001. In January 2002, he was appointed the Founding Director of the Center for Optoelectronics and Optical Communications at UNC Charlotte. He stepped down from this position in 2010 and has been Site Director for the NSF Industry/University Center for Metamaterials which began in 2011. He has been the Editor-In-Chief of the journal 'Waves in Random and Complex Media' since 1996 and is Deputy Editor of OSA's recently launched *Photonics Research Journal*. He currently serves on the OSA Board of Directors and the Advisory Board of the Optoelectronics Industry Development Association (OIDA). He is a Fellow of the OSA, IOP and SPIE.

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