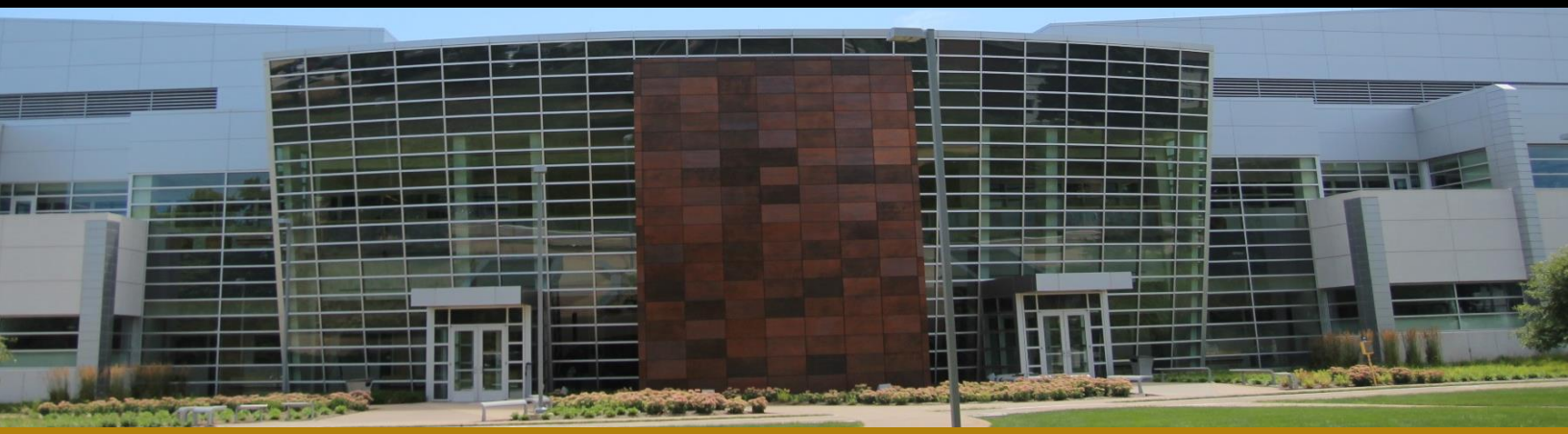
PURDUE UNIVERSITY



Birck Nanotechnology Center

Dr. Patsalas has studied Physics at the University of Ioannina (1992-1996), where he has been consistently a State Excellence Scholar (upper 1% student). Then, he joined Aristotle University of Thessaloniki (AUTh) for his graduate and doctoral studies on experimental solid state physics (Ph.D. 2001) for which he received the Young Scientist Award from the European Materials Research Society (Strasbourg-France). He was awarded a Post-Doctoral Fellowship for Excellent Research by the Research Committee of Aristotle University and established long-term collaborations with the University of Poitiers-France, where he has a part-time visiting professorship (Professeur Invité) and with Nottingham Trent University-UK, where he is still an active Visiting Professor. He joined the Department of Materials Engineering of the University of Ioannina (UoI) as Assistant Professor in 2004 and established the Low-Dimensional Materials Group. In March 2013, he joined the Laboratory of Applied Physics of AUTh as an Assoc. Professor and in 2017 has become a Professor of Advanced Materials. His research interests include thin film technology and surface science, predominantly for optical and optoelectronic applications. The activities of his group include the growth of thin films and self-assembly of nanostructures by physical (PVD, laser, plasma) and chemical (CVD, PECVD) techniques and the study of their electronic properties by a variety of spectroscopic techniques, such as XPS/AES/EELS, and Optical Spectroscopy, Spectroscopic Ellipsometry, Raman, and Photoluminescence. He has been coordinator of many national and European RTD projects, guest editor of various journals (Diam. Relat. Mater.; Surf. Coat. Technol.; Thin Solid Films; Mater. Sci. Eng. B; J. All. Comp.) and author or co-author of more than 150 peer-reviewed papers. He is a regular member of the European Materials Research Society (E-MRS) from 1998 to 2004, and member of the E-MRS Board of Delegates since 2004, for which he has organized 4 symposia, and he will be a symposium organizer in the forthcoming E-MRS Spring Meeting 2019.

The implication of using conductive nitrides as alternative plasmonic materials: going beyond TiN and ZrN

Prof. Panos A. Patsalas

Monday, April 30, 2018
11:30am – 12:30pm
BRK 2001

The nitrides of the group IVb-Vb-VIb transition metals (TiN, ZrN, HfN, VN, NbN, TaN, CrN, MoN, WN) constitute the unique category of conductive ceramics. Having substantial electronic conductivity, exceptionally high melting points and covering a wide range of work function values, they were considered for a variety of electronic applications, which include diffusion barriers in metallizations of integrated circuits, Ohmic contacts on compound semiconductors, and thin film resistors, since early eighties. Among them, TiN and ZrN are recently emerging as significant candidates for plasmonic applications. So the possible plasmonic activity of the rest of transition metal nitrides (TMN) emerges as an important open question. All these nitrides tend to form films and nanostructures of extremely fine grains, when polycrystalline, due to their refractory character. In addition, TaN, WN and MoN were found to be metastable and they are stabilized in the cubic structure by the incorporation of point defects. As a result, there is interplay between the beneficial effect of the point defects in terms of structural stability and the deterioration of the plasmonic performance due to the subsequent increase of electron losses. In this seminar, the optical properties of VN, NbN, TaN, WN, and MoN polycrystalline and epitaxial films will be reviewed and will be critically evaluated by comparing them with *ab initio* calculations of the band structure of the ideal cubic crystals. Their optical performance will be also correlated with their Raman spectra, which are sensitive to the existence of structural defects. Based on the presented results it is proposed that NbN and MoN can be two very promising candidates for near and far UV plasmonics, respectively, while TaN can be also a viable alternative, albeit exclusively in epitaxial form.

PURDUE UNIVERSITY Discovery Park