

Physics Seminar
Wednesday, January 22, 2020
132 Oelman Hall 12:20 – 1:15

Ceramic Nanotechnology for Sensors and Photocatalysts

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My research over the past two decades has focused on polymorphic ceramic oxide systems- their novel synthesis, characterization and use in diverse applications. Through tailored processing of metastable oxide phases, we have developed in my research group selective gas sensing probes that can be used to monitor biomarkers (volatile organic compounds and other signaling metabolites) in exhaled breath and skin. These are built into portable and handheld artificial olfaction systems which allow for the non-invasive and non-intrusive detection of a variety of diseases and metabolic malfunctions, e.g. from asthma to sleep disorders. They may also allow for the monitoring of diabetes as well as monitoring human performance in extreme environments. Another area of my expertise involves the processing of complex 3D self-supported architectures of nanostructures ceramics and composites. Using scalable nanomanufacturing techniques, such as the needle-less high-throughput electrospinning that we have developed in-house, we have demonstrated continuous formation of single crystal oxide nanofibers as well as Nanogrids™ which may be used as photocatalytic blankets using solar energy to decompose pollutants in water and to produce energy from water splitting. My most recent work has been exploring the Chevrel Phase material system of ternary molybdenum chalcogenides produced by a combination of SHS processes and electrospinning. Through all these studies, the aim has been to use ceramic nanotechnology for a healthier and safer world.

Professional Biography: Dr. Pelagia-Irene (Perena) Gouma is currently the *Edward Orton Jr., Chair in Ceramic Engineering at The Ohio State University*. Her previous appointment was with the Institute of Predictive Performance Methodologies (IPPM) and with the MSE Dept. (tenured Full Professor) at the University of Texas-Arlington. Before that, for 16 years, she was a Professor at the State University of New York in Stony Brook, and the Founder and Director of the Center for Nanomaterials and Sensor Development (CNSD). She holds a B.Sc. degree in Applied Physics from the Aristotelian University in Thessaloniki Greece; a M.Sc. (Eng) degree in Materials from the University of Liverpool, UK and a M.Phil in Organizational Management from the same Institution. She received her Ph.D. in Materials Science and Engineering from The University of Birmingham in the UK. Dr. Gouma's research activities involve the synthesis and characterization of nanomaterials for bio-/chemical sensors and biotechnology as well as the development of artificial olfaction systems (breath analyzers, electronic noses and tongues). Dr. Gouma has established novel and highly successful programs on nanomedicine, with emphasis on the development of non-invasive breath and skin-based diagnostic tools. Other areas of her research include photocatalysts and sorbents for remediating water from fracking operations and self-supported photocatalytic blankets that float on water and produce energy from photochemical water splitting. She has been featured as an expert in nanomaterials, ceramics, sensors, and photocatalysts in numerous press releases (Science Nation, IOP, Science press, NPR, NBC news, Fox news, Fast Company, etc.). She has published over 140 peer-reviewed articles, 18 book chapters and editorials, and a monograph. She also holds 18 patents (both US and International). She is a member of the *National Academy of Inventors*, she was a **Fulbright Scholar** to UNICAMP in Brazil, and she has received the prestigious **Richard M. Fulrath** award of The American Ceramic Society. She has been elected a *Fellow of The American Ceramic Society* (2019). She was the sole Chair of the 2011 ISOEN Conference. Dr. Gouma can be reached at: gouma.2@osu.edu. Website: <https://acrl.osu.edu>