COMBUSTION WEBINAR

Flame-made gas sensing devices of high selectivity

Speaker: Sotiris E. Pratsinis, ETH Zurich, Switzerland

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Biography: Professor Sotiris E. Pratsinis is a Fellow of the Combustion Institute teaching Mass Transfer and Micro-Nano-Particle Technology at ETH Zurich where he advises four PhDs and four post-docs. He has graduated 44 PhDs, now at leading positions in industry and academia worldwide. With them he has published 400+ refereed articles & has 20+ patents that are licensed to industry & have contributed to creation of four spinoffs from which one joined the LSE on December 2020. His research on *multiscale* particle dynamics pioneered flame aerosol synthesis of several sophisticated nanostructured materials with closely controlled characteristics at kg/h, even at academic laboratories. This contributed to identifying the origins of nanosilver toxicity, led to novel heterogeneous catalysts and, for the first time, to flame-made gas sensors, nutritional supplements, dental and theranostic materials.

Abstract: Smartphones offer physical (voice, location and touch) recognition but not any molecular (chemical) recognition. Can combustion aerosol processes help here? Their steep temperature gradients and high particle concentrations during sensing particle formation give access to metastable compositions and fractal-like porous but rigid film structures, both unattained by conventional wet & dry processes. These characteristics have led already to sensors of high sensitivity, selectivity and stability along with short response / recovery times. Broad applications of chemical sensors, however, are hindered mostly by *selectivity*. This can be enhanced drastically by assembling sensing devices and capitalizing on pre-treatment of gas mixtures. So by placing a flame-made Pd-doped SnO_2 sensor downstream of a polymeric adsorbent bed enables selective detection of methanol at high ethanol concentrations in both liquor and human breath for prevention of methanol poisoning, a plague in the developing world. Second, the selectivity of breath acetone is enhanced by continuous catalytic destruction of interferants on flame-made catalysts before passing through flame-made Si-doped WO_3 sensors to monitor lipolysis (body fat burning). Such advances enable mobile health monitoring, on-site food safety assessment and air quality tracking (i.e. formaldehyde). A pdf of the talk is available from pratsinis@ethz.ch.

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