Flame aerosol synthesis of functional nanomaterials and devices

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Abstract

The lecture will start with a fascinating overview of flame aerosol technology from ancient China to the bible printing by Gutenberg and to the current manufacture of nanostructured commodities (carbon black, fumed SiO_2, pigmentary TiO_2 and filamentary Ni among others). Recent advances in understanding of combustion and aerosol formation and growth, including the structure and self-preserving size distribution by coagulation of fractal-like particles allow now optimal aerosol reactor design and inexpensive synthesis of nanoparticles with sophisticated composition, size and morphology. These lead to synthesis of heterogeneous catalysts, highly porous, self-assembled lace-like or cauliflower-like and transparent gas sensors, radiopaque but transparent dental fillers and even nutritional products by flame spray combustion at 1 kg/h even at an academic institution. Such units have been built now in UK, Spain and India. The research frontier now shifts to direct fabrication of nanoscale devices by stochastically depositing nanoparticles onto microelectronics. This motivates the development of gas sensors for early detection and monitoring of illnesses by breath analysis.