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Production of Zinc Oxide Scaffolds by Supercritical CO₂ Processing

Sudhir Kumar Sharma* and Ramesh Jagannathan
Engineering Division, New York University Abu Dhabi, UAE

The implementation of supercritical fluids has received a tremendous interest from the scientific community with the aim to upgrade the traditional technologies as well as to develop new technologies for the production of smart materials. The characteristics of smart materials at micro-nano scale are closely associated with their chemical composition as well as to their particle size. The production of such materials with specific properties is very important for numerous applications in catalysts, coatings, electronics, ceramics, superconductors, dyestuff, pigments, and pharmaceuticals.

We report a novel method for the fabrication of porous zinc oxide scaffolds by a scalable supercritical CO₂ (sc-CO₂) based nebulization process, under mild processing conditions (P = 145 bar; T = 110 °C). This process consists of evaporation of CO₂ enriched water micro-droplets (~ 3 μm diameter) deposited from an aerosol onto heated substrates at 135 ± 5 °C followed through coffee-ring effect. We produced hierarchically porous ZnO scaffolds with polycrystalline hexagonal wurtzite structure and space group of C_{6v}⁴ (P6₃mc). Photoluminescence emission (PLE) characteristics of as deposited scaffolds showed sharp NBE blue emissions whereas and post heat treated to 400 °C enhancement in the PL intensity with conventional green luminescence. We explored the feasibility of this process to produce zinc oxide scaffolds and utilize for potential applications in diverse fields of nanotechnology.

Biography:

Sudhir Kumar Sharma obtained masters (M.Sc. Physics and M.Tech. Materials) from Department of Physics, Barkatullah University (formerly Bhopal University) Bhopal, India. In 2012, he received his PhD from the Indian Institute of Science Bangalore, India. As post doc fellow, he joined at Centre for Nano Science and Engineering (CeNSE), IISc. Bangalore, India. Afterward's Dr. Sharma moved to New York University Abu Dhabi UAE (NYU Abu Dhabi) as a research associate in Nov. 2013. Currently, he is working as a Research Scientist at NYU Abu Dhabi. His publication record includes around 30 publications in international peer-reviewed reputed journals and more than 50 presentations in conferences. His research interest includes implementation of supercritical technologies for nanoparticle synthesis, Smart materials for micro-sensors and actuators, MEMS/NEMS and micro/nano-fabrications, vacuum science, and thin film technology.