

Department of Chemistry, IIT Madras

Ph.D. Second Seminar

Electrospray deposition: A route to novel materials

Name: Sandeep Bose (CY14D078)

Venue: CB 310

Date: 17.09.2019

Time: 4:15 pm

Abstract

Electrospray ionization is an established technique in the field of mass spectrometry for molecular ionization. Interestingly, this ionization technique has emerged as a novel tool in the field of materials science. Electrospray has been used to synthesize metal, metal oxide nanoparticles, and organic reactions. It has been used for the catalysis, and growth of anisotropic nanostructures. Synthesis of luminescent nanoparticles in a charged microdroplet is presented here occurring at an extremely fast time scale. One such luminescent materials are silicon nanoparticles. Preparation of luminescent silicon nanoparticles involves several techniques where the synthesis involves high temperature and pressure and requires prolonged time. However, electrospray offers a simple, solution-processed, and one-step method for the production of luminescent nanoparticles, without the requirement of harsh conditions. Additional advantage includes the increase in the rate of the reaction up to the order of billion-fold as compared to conventional methods. Synthesis in microdroplets is also useful for the formation of metastable silicon under *ambient* conditions. Electrospray has emerged as an important method for the synthesis of silicon nanoparticles from biomass such as rice husk which makes this method important for the large scale production from a readily available and cheap precursor. Droplet synthesis is not selective to some specific materials and employed for the preparation of molecular materials of gold and silver which are luminescent. All of these luminescent materials find potential applications in the field of solar cells, sensors, photonics, and nanoparticle-based bio-imaging, thereby extending its applicability in diverse areas.

References:

1. M. Yamashita, J. B. Fenn, *The Journal of Physical Chemistry* **1984**, 88, 4451-4459
2. D. Sarkar, M. K. Mahitha, A. Som, A. Li, M. Wleklinski, R. G. Cooks, T. Pradeep, *Adv. Mater.* **2016**, 28, 2223-2228.
3. Cullis, A. G.; Canham, L. T., *Nature* **1991**, 353, 335-338