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Synthesis of Gold Nanostructures by Fluidic Process

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Abstract

Anisotropic (irregular-shaped or branched) plasmonic nanomaterials have garnered extensive research interest because of their enhanced-cum-unique optical and electronic properties. Such peculiar properties make them attractive for several applications such as photovoltaic technology, optoelectronics, bio- and chemical sensing and nanomedicine. Fine tuning the shape and production of good quality i.e., uniformity in morphology and size, of anisotropic nanomaterials is a challenge in order that they can be used in varied applications. Bulk wet chemical synthesis suffers from drawbacks such as poor control over reagent addition, mixing, reaction time and temperature leading to polydispersity in nanomaterials and hence non-reproducibility from one batch to another. Herein, we present a fluidic approach to synthesize anisotropic gold (Au) nanostructures in a continuous-flow using a flow reactor made by three dimensional (3D)-printing technology. Stereolithography (SLA), a type of 3D-printing technique was used to fabricate the reactor. Three different reducing agents (ascorbic acid, hydroxyquinone and polyvinylpyrrolidone) of different concentrations were used to synthesize the plasmonic nanomaterials. The nanomaterials were extensively characterized by spectroscopic and microscopy methods that revealed flower-, urchin- and spindle-shaped morphologies of Au nanomaterials.

Keywords: anisotropy; plasmonic nanomaterials; droplet-based method; three dimensional (3D)-printing; flow reactor