

**Name of the Speaker:** Dr. M. S. Bootharaju

**Date:** 27<sup>th</sup> July 2022 at 4:00 pm in AB25A/B

**Title of the talk:** Molecular nanoparticles

**Abstract:** The nanostructured materials exhibiting exotic optical and chemical properties promise diverse applications in optoelectronics, catalysis and energy conversion. While the size of the colloidal nanoparticles of metals and metal chalcogenides has long been known to play a critical role in unveiling unusual properties, challenges in achieving atomic level control with complete monodispersity limit our precise understanding of the size effects. Nanoclusters – structurally and compositionally precise single-sized nanomolecules, or simply, molecular nanoparticles – are an emerging class of molecular materials, which are anticipated to establish structure-property correlations and enable the understanding of the evolution of various materials properties at discrete superatomic levels.

This seminar will cover the synthesis and self-assembly, and enhancement in the photophysical and catalytic properties as well as the unusual ligand- and metal-exchange reactions of metal chalcogenide/chalcogenolate nanoclusters. The single-heteroatom-doped nanoclusters provided unprecedented opportunities to unravel the dopant effects on the stability, photoluminescence and electronic structure. The successful synthesis of the first silver nanocluster Ag<sub>25</sub> with an exact structure of its gold analogue Au<sub>25</sub> paved the way to compare or contrast their properties. By designing the suitable ligand-exchange strategies, it has been shown for the first time that the nanoclusters can reversibly be transformed from one size to the other just like molecules. Furthermore, a new class of hydride-rich silver nanoclusters, including Ag<sub>18</sub>H<sub>16</sub>, Ag<sub>26</sub>H<sub>22</sub> and Ag<sub>25</sub>H<sub>22</sub> have been synthesized, which are expected to act as both hydrogen source and catalyst for hydrogenation reactions. One of the next big things in the field of molecular nanoscience is assembling nanoclusters into extended solids for various applications. I will conclude my talk by showing some implications of the properties of nanoclusters in prospective applications, especially in nanocatalysis.

**For further reading:** *Chem* 2022, <https://doi.org/10.1016/j.chempr.2022.06.025>; *Nat. Mater.* **2021**, 20, 650; *Angew. Chem. Int. Ed.* **2021**, 60, 9038; *JACS* **2021**, 143, 326; *JACS* **2020**, 142, 13974; *JACS* **2020**, 142, 14190; *JACS* **2019**, 141, 8422; *JACS* **2019**, 141, 7037; *Chem. Mater.* **2018**, 30, 2719; *JACS* **2017**, 139, 1053; *JACS* **2016**, 138, 13770; *JACS* **2016**, 138, 14727; *Angew. Chem. Int. Ed.* **2016**, 55, 922; *Angew. Chem. Int. Ed.* **2016**, 55, 5749; *Chem. Mater.* **2016**, 28, 3292; *Chem. Mater.* **2015**, 27, 4289; *JACS* **2015**, 137, 11970; *JACS* **2015**, 137, 11578.

**About the speaker:** Dr. M. S. Bootharaju is currently a Research Professor in Prof. Taeghwan Hyeon's (Taeghwan Hyeon - Google Scholar) research group at Seoul National University, South Korea. He is a recipient of the prestigious IBS Young Scientist Fellowship (IBS-R006-Y2). He worked with Prof. T. Pradeep and received his Ph.D degree (2014) in Chemistry from IIT Madras, Chennai. During 2014-2018, he was a postdoctoral fellow at King Abdullah University of Science and Technology (KAUST), Saudi Arabia. He has authored and co-authored about 50 research publications and four book chapters. His research has been highly cited (3839) in the field and it carries a decent google scholar h-index of 31 (M S Bootharaju - Google Scholar).