Chemical reactions in molecular flasks

Partha Sarathi Mukherjee.

Inorganic and Physical Chemistry Department, Indian Institute of Science, Bangalore-560012.

Abstract

Coordination-driven self-assembly is an efficient strategy for constructing molecular architectures with well-defined shapes and sizes. In this lecture, I will discuss the design of several water-soluble Pd(II)-based discrete molecular architectures featuring hydrophobic confined nanocavities. Owing to the restricted degrees of freedom experienced by chemical entities within these confined nanospaces, their properties can differ significantly from those observed in bulk media.

A major focus of the lecture will be our recent findings on how the shape of molecular vessels influences the outcome of chemical reactions. I will also highlight the incorporation of functionality into ligand frameworks to develop functional architectures, and incorporation of photosensitizers into confined space for selective photocatalytic oxidation and other stereoselective reactions. These studies demonstrate how rational molecular design can be employed to control reactivity and achieve selective transformations in confined environments.

Recent Publications

1. Saha, R., Mondal, B., Mukherjee, P. S. *Chem. Rev.* 122 (2022) 12244.

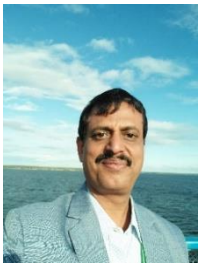
2. Pradhan, S., Rinshad, V., Hickey, N., Mukherjee, P. S. *Angew Chem. Int. Ed.* (2026), e2304851.

3. Maitra, P. K., Ali, S., Malinska, M., Mukherjee, P. S. *Angew Chem. Int. Ed.* (2026) e9339199.

4. Dey, S., Banerjee, R., Hickey, N., Mukherjee, P. S. *J. Am. Chem. Soc.* 147 (2025) 32904.

5. Banerjee, R., Bhandari, P., Hickey, N., Mukherjee, P. S. *J. Am. Chem. Soc.* 147 (2025) 23049.

Biography



Prof. Mukherjee is a professor of chemistry at the Indian Institute of Science in Bangalore. He works on discrete molecular architectures including the use of their confined nanospace for catalysis, separation of isomers/enantiomers, and in biological applications. He is an elected fellow of the world academy of sciences (TWAS) and the Indian National Science Academy. He is currently serving the ACS *Inorganic Chemistry* as its associate editor.