Facile self-assembly of metallo-supramolecular ring-in-ring and spider web structures using multivalent terpyridine ligands

A research team led by Professor Yi-Tsu Chan in the Department of Chemistry at National Taiwan University aims to develop facile approaches to the assembly of predesigned building blocks into desired nanostructures via weak intermolecular interactions. Building on fundamental coordination and organic chemistry, they conduct systematic studies on how ligand geometry affects self-assembled structures in solution. Recently, it was found that a series of metallo-supramolecular ring-in-ring structures could be readily generated by mixing Cd^{II} ions with multivalent terpyridine ligands composed of one 60°-bent and two 120°-bent bis(terpyridine)s with varying alkyl linker lengths under ambient conditions. Mechanistic study of the self-assembly process excluded a template-directed pathway and showed that the intramolecularly complexed species was the key intermediate that underwent cooperative coordination to afford the ring-in-ring structure. Furthermore, a novel metallo-supramolecular spider web was produced in quantitative yield using the elongated decakis(terpyridine) ligand. This multivalent ligand design enhanced both the rigidity and the stability of the predesigned assemblies, thereby significantly reducing the possibility of the formation of unwanted products. The presented strategy opens an avenue for exploiting sophisticated supramolecular topologies.

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