Photochemistry in nanocontainers

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Molecular switches, entities that can be toggled between two or more forms upon exposure to an external stimulus, often require conformational freedom to isomerize. Confining these molecules to volumes only slightly larger than the molecules themselves can profoundly alter their properties. Molecular switching events often entail a dramatic conformational change that require the confining cage to be flexible enough to adapt to the shape of the guest and allow it enough freedom to successfully switch between the different conformers. In the absence of the cage the photoswitching can be either suppressed or the guest can be excluded from the solubilizing medium.

This work presents a flexible, water-soluble coordination cage encapsulating molecules such as spiropyran and azobenzene derivatives. The single crystal X-ray diffraction structures of the complexes reveal that upon binding the guest or guests, the cage undergoes significant structural changes to adapt. The crystal structure unit cell volume is relatively large and contains a cage, one or two guest and numerous counter ions and solvent molecules.

These newly synthesized materials are a novel type of information storage medium in which messages could be written and erased in reversible fashion using light. Furthermore, the encapsulation of external stimuli induced conformational change molecules is a step towards construction of molecular machines.