Saving the Planet: Toward a Sun-charged Thermal Molecular Battery

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A major challenge in the utilization of solar energy is its storage. To meet this challenge, we must develop appropriate technologies and materials. We are investigating organometallic frames as platforms for the development of solar storage-thermal release devices featuring a closed-(re)cycle operation: rechargeable thermal "batteries". In contrast to conventional physical-thermal storage methods (e.g., those based on molten salts), which require heat insulation to prevent energy loss, this chemical scheme possesses the advantage of loading solar energy into the bonds of a kinetically stable photoisomer. The latter readily releases its energy "on demand" in the form of heat, thermally or when exposed to a catalyst. Two systems will be presented: a phenylene cobalt frame A, in which the metal slides reversibly along the π-ligand, and the fulvalene ruthenium assembly B, which undergoes a reversible 180º rotational "twist".