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In-Situ RIXS Study of Charge Transfer in Artificial Photocatalysts

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There are emerging technologies of using nanostructured semiconductors and charge transfer processes for solar conversion to chemical fuels for energy use and storage. The ability to control the particle size, morphology and composition of nanoparticles is of crucial importance nowadays considering the extensive high-tech applications of 3d metal compounds in the applications of photosynthesis. XAS, XES, and RIXS are probes of the local, molecular electronic structure particularly relevant to catalysis: oxidation state, coordination environment, π-backbonding/σ-donation, d-p hybridization, and metal-ligand charge transfer. The presentation shows that the electronic structure of the reaction intermediates of the catalysts is obtained from L-edge XAS, XES and RIXS of the transition metals. The charge transfer in Co3O4 nanoclusters grown in silica nanopores that act as efficient and robust catalysts for water oxidation has been revealed, so as to an all-inorganic, oxo-bridged heterobinuclear TiIVOMnII group covalently anchored on a silica nanopore surface as charge-transfer chromophores for driving multielectron catalysts in artificial photosynthetic systems.

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Talk

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