Observing electron dynamics in blue copper proteins by resonant inelastic x-ray scattering (RIXS)

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Blue copper proteins, such as azurin and amicyanin, play key roles in biochemical reactions such as electron transport, radical scavenging, and nitrogen fixation. The unique electronic structure motifs at the copper center endows unprecedented redox activity as oxidants and electron acceptors for most copper metalloproteins. Orbital hybridization at the Cu-amino acid complex at the metalloprotein active site enables tunable covalency and stability for the metal-ligand bond, through which the relative stability of the Cu 2+/1+ oxidation states, and consequently, the redox potential can be controlled. While such metal-ligand bond covalency have been investigated through optical/x-ray absorption spectroscopy, the roles of electron correlation and vibronic coupling in redox potential are yet to be elucidated. In this work, the prospects of resonant inelastic x-ray scattering (RIXS) towards the elucidation of electron dynamics in the active site copper centers of blue copper proteins, azurin and amicyanin, will be presented. Of note is how RIXS can probe relevant *dd* excitations and the accompanying electron redistribution and ligand motion.