

Photoinduced electron transfer in base metal dyads by ultrafast X-ray emission at free electron lasers

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Active base metals can increase the sustainable character of photocatalytic proton reduction (PCPR). In photosensitizers and photocatalysts, metals like iron and cobalt compounds can be used. However, due to the limited knowledge about the working principle of such elements in PCPR, fundamental new insights are required.

X-ray emission spectroscopy at X-ray free electron lasers provides unique details about the excited state dynamics.[1] Fe-Co dyads (Fig. 1) offer the chance of vectorial electron transfer and show catalytic activity.[2] Nevertheless, the exciting state landscape is completely unexplored. Thus cutting-edge ultrafast two-color emission experiments [3] at XFELs with femtosecond resolution were employed, which recorded the emission lines of both metal sites in Fe-Co dyads simultaneously. As will be discussed, they show unprecedented excited state behaviour and prove an ultrafast electron transfer from the photoactive iron site to the cobaloxime catalyst. Additionally, the principle, scope and limitation of such measurements will be discussed.

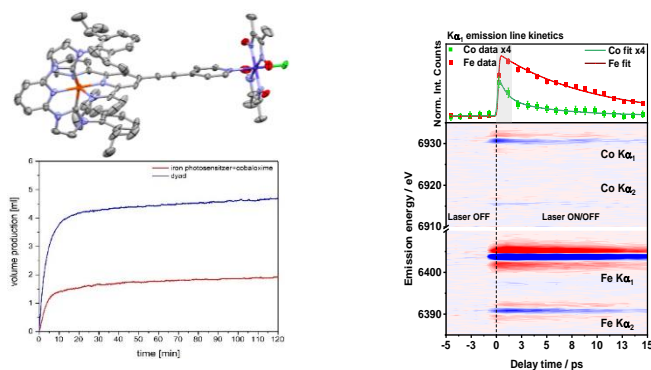


Figure 1. X-ray structure of a Fe-Co dyad and its activity in photocatalytic proton reduction (left) and time-resolved two-color Ka X-ray emission signal at both the iron and cobalt K-edge (right).

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References

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