Photodynamics of transition metal complexes by versatile time-resolved spectroscopy at ELI Beamlines

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Transition metal complexes keep attracting attention for their rich photophysical, photochemical, and electrochemical properties that underlie their use as photoredox catalysts, solar-cell sensitizers, or electrochromic materials. Their unique properties derive from a variety of excited-state electronic configurations accessible with X-ray, UV, VIS and IR radiation. Subsequent relaxation processes are typically multistep complex phenomena occurring in timescales from fs to ms. Hence, the thorough elucidation of photodynamics of coordination compounds is experimentally challenging and very often requires combination of various spectroscopic techniques in different spectral and temporal range.

One of the missions of ELI Beamlines is to develop a new generation of sources for ultrashort pulses such as a High Harmonics Generation (HHG) source and a Plasma X-ray Source (PXS) driven by high power kHz lasers [1,2]. Important advantage of these sources is potential to be used in combination with beams split off from their corresponding drive lasers. This feature ensures intrinsic synchronization between the beams in ultrafast pump-probe experiments. It provides the complementary capabilities in optical, VUV and X-ray spectroscopy in one location. Such a platform is an excellent tool for study of complex photodynamics of various systems.

Here we present a short summary of time-resolved spectroscopic experiments performed at ELI Beamlines on different transition metal complexes. In particular we discuss photodynamics of Ru and Re photosensitizers/photocatalysts [3] and dicopper-disulfide biomimetic complex [4].

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