

Reaction Dynamics Studied at PAL-XFEL

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The pump-probe X-ray diffraction and scattering techniques have now been fully established as a powerful method to investigate molecular structural dynamics. We have employed the techniques to study structural dynamics and spatiotemporal kinetics of a wide variety of molecular systems including diatomic molecules, haloalkanes, organometallic complexes and protein molecules over timescales from femtoseconds to milliseconds. To emphasize that structural information can be obtained from the liquid phase, this time-resolved X-ray solution scattering technique is named time-resolved X-ray liquidography (TRXL) in analogy to time-resolved X-ray crystallography where the structural information of reaction intermediates is obtained from the crystalline phase. TRXL has been successfully used to reveal the structural dynamics of various biological reactions as well as small molecules. We will present our results obtained with femtosecond TRXL at PAL X-ray free-electron laser (PAL-XFEL), including the direct observation of bond formation process, roaming-mediated isomerization, optical Kerr effect, and protein structural dynamics. (Acknowledgement: This work was supported by the Institute for Basic Science (IBS-R033)).

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