

by detecting the fluorescence X-ray signals just after and just before the laser pulse using gated integrators synchronized with the laser pulse (945 Hz). [7] Obtained results clearly demonstrate the success in probing both structural and electronic state changes induced by 267nm femtosecond laser pulse excitation with 100ps resolution.

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Development for X-ray Crystal Structure Analysis of a Surface-Shallow Layer

Koshiro Toriumi,^a Hiroaki Yamanaka,^a Aki Takazaki,^a Daisuke Yamashita,^a Minoru Mitsumi,^a Yoshiki Ozawa,^a Osamu Sakata,^b
^a*Department of Material Science, University of Hyogo, Kamigori-cho, Hyogo (Japan).* ^b*National Institute for Materials Science/SPring-8, Sayo-gun, Hyogo (Japan).* E-mail: toriumi@sci.u-hyogo.ac.jp

Chemical and physical phenomena that happen in a shallow layer of a crystalline material such as photo-induced chemical reaction and transport of small molecules on crystal surface should be elucidated more clearly if three-dimensional structure of the crystal surface layer up to 1 μm in depth could be determined by a depth-resolved X-ray diffraction technique. This new diffraction method could be achieved by measuring diffraction intensities on the condition of exactly controlling the X-ray penetration depth.

Epitaxial crystals of the halogen-bridged mixed-valence platinum(II,IV) complexes should be suitable to evaluate whether the structure analysis of a surface shallow layer can be achieved. The surface film crystal of the chloro-bridged platinum(II,IV) complex (1) was successfully crystallized on the (001) plane of the bromo-bridged platinum(II,IV) base crystals (2) which was isomorphous to (1) with slightly different cell dimensions. The X-ray diffraction experiments were performed using the multi-axis diffractometer at SPring-8 BL13XU. The epitaxial crystals of (1) that grows up on the substrate of (2) with dimensions of 1.25x0.5 mm by thickness of about 0.3 μm was investigated.

Out-of-plane reflections were measured using 8 keV X-ray beam focused on 3x4 μm with 2D lens for a grazing incident angle of 0.1°–0.7°. The diffraction image measured for a grazing incidence of 0.3° is shown in Figure 1. Reflections from the surface film crystal of (1) and those from the substrate of (2) are observed as sharp Bragg spots without powder lines. The reflection pairs with the same indexes are located at neighboring positions. This indicates that the epitaxial film crystal is just a single crystal with its orientation being almost the same as the substrate crystal. Integrated intensities of both the film and substrate crystals were obtained. Although the measured intensity ratios of the film crystal to the substrate become smaller as incident

angle increase, its decreasing ratio is smaller than the value calculated for the thickness of the film crystal. This suggests that it is necessary to improve smoothness on the crystal surface.

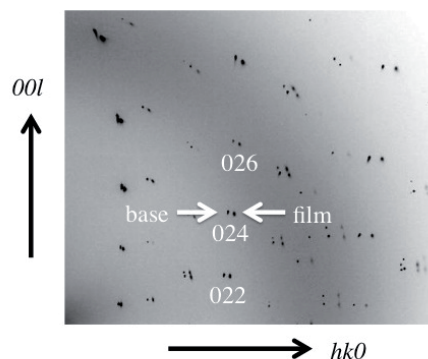


Fig. 1. Diffraction images measured for a grazing angle of 0.3°.

Keywords: surface, structure, epitaxial

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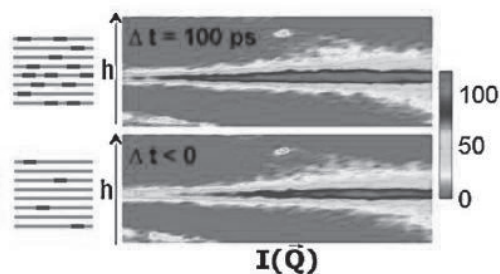
Evidence of one-dimensional precursors in the photoinduced transformation in TTF-CA

Laurent Guérin,^{a,b} Eric Collet,^a Johan Hébert,^a Marylise Buron-Le Cointe,^a Shin-ichi Adachi,^b Shin-ya Koshihara,^b Hervé Cailleau^a
^a*Institut de Physique de Rennes, Université de Rennes1, (France).* ^b*JST Exploratory Research for advanced Technology, Tsukuba, (Japan).* E-mail: laurent.guerin@univ-rennes1.fr

The photoinduced phase transition in TTF-CA was intensively studied the last ten years both experimentally and theoretically [1–4]. It is the archetype organic system where cooperativity [1] and coherence [5] play a major role in the transformation. Here we investigate the precursors of the photoinduced phase transition in the highly cooperative charge-transfer molecular crystal TTF-CA and provide key insights. The photogeneration of one-dimensional nanoscale clusters was detected by time-resolved diffuse x-ray scattering with 50-ps time resolution at NW14 beamline, KEK, Japan.

The mapping of the diffuse plane shows a time dependence after excitation and is the direct signature of the formation of 1D clusters induced by light occurring at the first step of the photoinduced phase transition. [6]

Such clustering of structurally relaxed electronic excitations is expected to be a common process in many materials presenting photoinduced transformations.



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