Micro-Crystal Structure Analysis and Its Application to the Study of Photo-Induced Structural Change of the Metal Complex

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Introduction. Molecular structure analysis in a photo-excited state by single crystal diffractometry should be extremely interesting from many points of view such as the chemical reaction of molecules and solid state physics of a crystal. However, the excited state crystallography has not been carried out except for the frontier work by Coppens et. al, since many difficulties such as low concentration of excited state molecules, small penetration depth of exciting light, heating of a crystal by energy conversion from photon energy to thermal vibration. Accordingly, it should be necessary to use an extremely small crystal with dimension of μm and cool a crystal as low as possible in the experiment.

Experimental and Results. Several preliminary experiments were made by using the vacuum X-ray camera with an imaging plate as a detector and 30 keV X-ray beam monochromated by Si(311) monochrometer. The vacuum IP camera, which is mounted on aϕ axis of the 7-circle goniometer at BL02Bl, is expected to be free from air-diffracted noise and achieved the high S/N ratio. Background intensities were measured for the evacuated and non-evacuated cases; background noise could be reduced from some hundreds to below ten counts/pixcel.

Halogen-bridged mixed-valence diplatinum complex $Pt_2(dta)_4I$ having a linear chain structure exhibits anomalous electrical conducting behavior and structural phase-transition, which should be correlated to electron-lattice interaction induced by the thermal vibration. Since some electronic structures were expected along the linear chain, an x-ray rotation photograph around the chain axis was taken by the vacuum camera. Weak diffuse streaks between Bragg spots could be observed, indicating ordering of the Pt(II) and Pt(III) along the linear chain (Fig. 1). The vacuum camera with low-background area detector and bright x-ray source from SPring-8 is very suitable for detecting such very weak diffuse streaks.

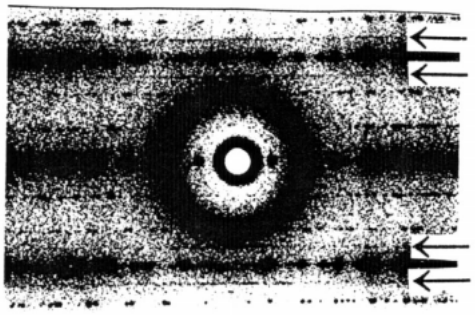

Fig.1.The rotation photograph of $Pt_2(dta)_4I$. Arrows indicates the diffuse streaks.