Gigantic increase of the physical properties on metal oxides

by

X-ray core level excitations

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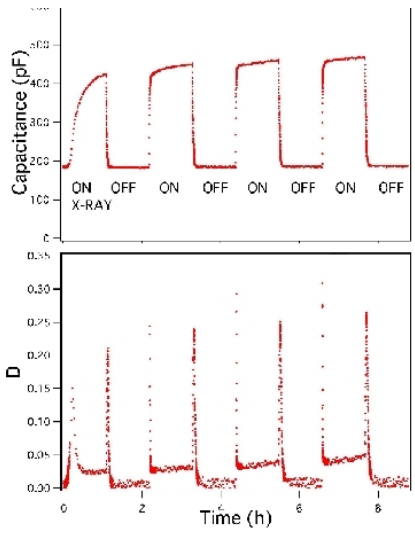
Photo-induced phase transition has been studied extensively in this decade because this phenomenon could not be only applied to noble photoelectric devices such as ferroelectric random access memory, photomemory, photoswitch, and also be related to a basic science in which a cooperative interaction between exited states plays an important role to stabilize a new phase. Recently Takesada et al. found a gigantic photoinduced dielectric constant of quantum paraelectric Perovskite oxides, such as $SrTiO_3$ and $KTaO_3$, by UV light irradiation under a weak DC electric field. The origin of this phenomenon is still under discussion in the best of our knowledge. By taking consideration to a possibility of phase transition, we have carried out synchrotron X-ray experiments on $KTaO_3$ in order to get the structural information on this phenomenon. Surprisingly, however, the similar phenomenon to the observation under UV and DC condition has been also observed without DC electric field only by X-ray irradiation. In addition, the X-ray irradiation gives a memory effect to the sample, i. e. the capacitance is decreased immediately to the original value by stopping the X-ray irradiation, but a rapid increase of the capacitance by the re-irradiation of X-rays followed by its gradual increase, as can be seen in Fig. 1.



Another example of gigantic increase of the property by core level excitation

is observation of the photo-catalytic activity enhanced by Ti-K edge） X-ray energy irradiation to TiO_2. The detail will Fig. 1 be discussed in the talk. The present works are done by the collaboration with Y. Nishihata, M. Takesada, T. Yagi for $KTaO_3$, and with K. Tamura, Y. Ohko, T. Tatsuma A. Fujishima, H. Yoshikawa, H. Kawamura for TiO_2