In-situ time resolved XAFS studies on catalysts.

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X-ray absorption fine structure(XAFS) is referred to a modulation in the X-ray absorption coefficient appearing near and above the X-ray abosorption edge. It reflects the local (geometric and electronic) structure around the x-ray absorbing atom. Since it does not require the long range order, one can get the information about the highly dispersed species on surfaces. Moreover we can measure the the XAFS spectra at any conditions such as high tempreature and high pressure. Synchrotron radiation, which provides a brilliant X-ray, can enables us to carry out μsec $\sim$ msec time resolution measurements. We can carry out *in situ* time resolved measurements of catalyst materials. I first review our previous *in situ* time-resolved works.

- One is DXAFS(Dispersive XAFS) studies on teh Pt nanoparticle on the MCM-41 during H_2 and O_2 reactions. The correlation between structure and adsorption was observed.[1]
- The other is the QXAFS(Quick XAFS) measurements of hydrodesulfurization catalysts, Ni_2P under reaction conditions. The reaction mechanism and active site structure were determined by the simultaneous measurements of QXAFS, FT-IR and gas phase analysis[2, 3].

Finally we desrcibe our recent work on XFEL measurements of photocatalyst and its electron transfer processes in SACLA. We will discuss the future direction of XAFS in the application to dynamic studies of chemical precesses.

References

[1] Suzuki A, Inada Y, Asakura K, Nomura M (2006) Time-resolved structure change of Pt/MCM41 by the adsorption of H_2 and O_2. *PF activity reports* **23**:39

[2] Wada T, Bando KK, Miyamoto T, Takakusagi S, Oyama ST, Asakura K (2012) Operando QEXAFS studies of Ni_2P during thiophene hydrodesulfurization: Direct observation of Ni-S bond formation under reaction conditions *J.Synchro.Rad.* **19** :205-209.

[3] Bando KK, Wada T, Miyamoto T, Miyazaki K, Takakusagi S, Koike Y, Inada Y, Nomura M, Yamaguchi A, Gott T, Ted Oyama S, Asakura K (2012) Combined in situ QXAFS and FTIR analysis of a Ni phosphide catalyst under hydrodesulfurization conditions. *J. Catal.* **286** :165-171.