

In-situ EXAFS(Extended X-ray Absorption Fine Structure) study on the nucleation and growth of Ni/SiO₂ catalysts

J.C. Yang, and Y.G. Shul

Dept. of Chemical Engineering, Yonsei Univ. 120-749, Sinchondong, Sudaemungu, Seoul, KOREA

In catalysis, supported catalysts are consists of active material(cation, metal, and oxide) and support (metal oxide, non-oxide, polymer) to provide high surface area. Although some evidences of interactions between the active material and support are suggested, there appears no systematic description of such interactions. Recently, active metal ions support interactions(ISI) in catalysis preparation are well studied by using Ni/SiO₂ systems[1]. Transition metal ion(TMI), in this system Ni ion, is most appropriate probe to follow the interactions with the support all along its preparation and also act active sites in oxides support. Those successive transformation of Ni coordination sphere had been reported by using UV-Vis, TPR, TEM, and EXAFS[2]. Among those method, EXAFS(Extended X-ray Absorption Fine Structure) is the suitable surface characterization method to monitor the local structure around Ni atoms. In this study, the continuous monitoring of nucleation and growth of Ni atoms have been investigated by in-situ EXAFS method. Specific nucleation site of metal ions and aggregation behaviour with different chemical environment could be monitored by in-situ EXAFS method.

Ni/SiO₂ catalysts with different chemical environment were prepared by ref. 1. In-situ EXAFS spectroscopy of Ni/SiO₂ catalysts were measured by EXAFS beam line(7C, 10B) at Photon Factory(Tsukuba, Japan). For EXAFS measurement, Ni/SiO₂ samples were pressed into self supporting wafers. The EXAFS and XANES spectra at Ni K-edge are collected in transmission mode. The temperature of Ni/SiO₂ samples were heated at a rate of 1.5C/min to 500C.

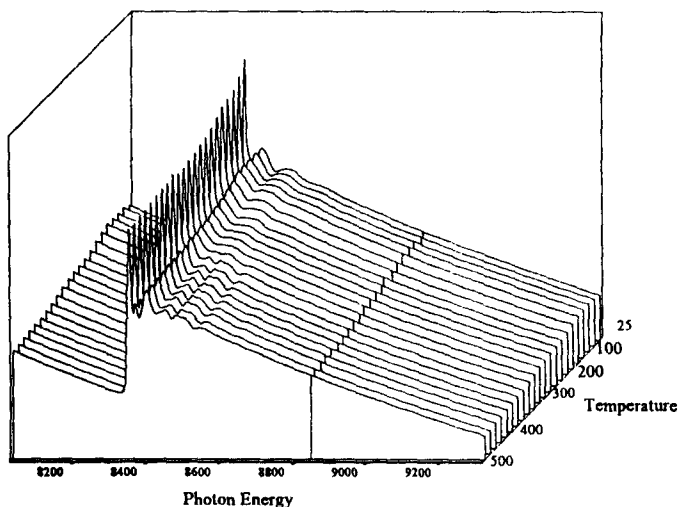


Fig. 1. In-situ EXAFS spectra of Ni/SiO₂ sample prepared by impregnation method.

chemical environment of Ni/SiO₂ catalyst can be monitored in our study.

Fig. 1 shows the in-situ EXAFS spectra of Ni/SiO₂ sample prepared by impregnation method.

The drastic changes of EXAFS spectra of Ni/SiO₂ sample begin to occur at about 300C. And oxidation state of Ni species are shown at 500C. In these in-situ monitoring of Ni/SiO₂ catalysts, the continuous monitoring of EXAFS measurement of Ni/SiO₂ catalysts was possible and the oxidation behaviour of nickel particles can be observed in our in-situ study. The different nucleation and growth behaviour of Ni particles with changing

Reference

1. O. Clause, L. Bonneviot, and M. Che, *J. of Catal.* 138, 195 (1992).