

EXAFS Measurements of Nd³⁺-doped Glasses on the Nd K-edge

Hiroataka Yamaguchi*, Hiromichi Takebe¹ and Kenji Morinaga¹

Electrotechnical Laboratory, 1-1-4 Umezono, Tsukuba, Ibaraki 305-8568

¹*Department of Materials Science and Technology,*

Graduate School of Engineering Sciences, Kyushu University,

6-1 Kasugakouen, Kasuga, Fukuoka 816-8580

We have studied the local structure of rare-earth ions in comparison with the Judd-Ofelt parameters in glasses. In the previous experiment (1997B160-NX-np), we attempted to measure absorption and fluorescence spectra of some neodymium-doped alkali silicate glasses on the Nd K-edge. The spectra, however, suffered some serious glitches because the monochromator was still under adjustment. In the present study, we have attempted the measurement again, then we successfully collected the EXAFS data.

White X-ray beam was monochromatized by an Si (311) double-crystal monochromator and the intensities of incident and transmitted beam were monitored by ionization chambers filled with krypton gas.

The samples were neodymium-doped alkali silicate and alkali phosphate glasses; $x\text{A}_2\text{O}-(100-x)\text{SiO}_2:0.3\text{Nd}_2\text{O}_3$ and $x\text{A}_2\text{O}-(90-x)\text{P}_2\text{O}_5-10\text{Al}_2\text{O}_3:0.3\text{Nd}_2\text{O}_3$, $\text{A}=\text{Li}, \text{Na}, \text{K}$, and $10 < x < 40$. The typical dimensions of the samples were $15 \times 10 \times 5 \text{ mm}^3$. X-ray was transmitted along the longest edge of the samples in order to gain sufficient absorption step on the Nd K-edge enough to detect the fine structure. The matrix contribution in total absorption is so small at the Nd K-edge (43.57 keV) that the EXAFS was successfully detected.

The obtained EXAFS, $k^3\chi$, and the Fourier transform for a sample, $40\text{Na}_2\text{O}-60\text{SiO}_2:0.3\text{Nd}_2\text{O}_3$, are shown in Fig.1 and Fig. 2, respectively. The most prominent peak in the Fourier transform is the contribution of the oxygen atoms at the nearest neighbor sites. The K-edge-EXAFS shows the local structure with higher resolution than the L₃-edge one, thereby

allowing us more precise structural analysis. The structural parameters determined in this study generally agree with those by the Nd L₃-edge data. Detailed analysis is in progress.

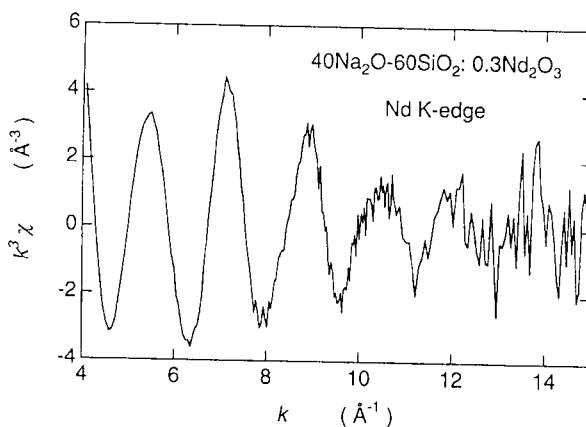


Fig. 1

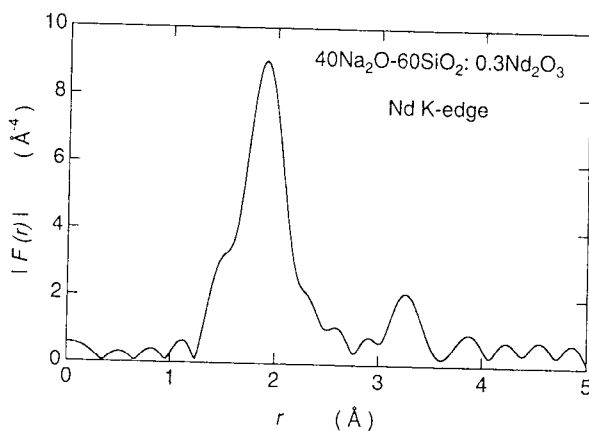


Fig. 2