# Applications of Diamond Phase Retarder to Inelastic X-ray Scattering

**N. Hiraoka (平岡望) and K.-D. Tsuei (崔古鼎)**

**National Synchrotron Radiation Research Center, Hsinchu, Taiwan**

Horizontally polarized x-rays, typically emitted from a synchrotron radiation source, leads to a problem for the so-called horizontal arm spectrometer. The intensity is substantially suppressed at the scattering angle near 90°, corresponding to the momentum transfer (**q**) of ~ 7 $A^{-1}$ for 10 keV x-rays, as is given by the polarization factor for Thomson scattering. We reported in the last experiment that the problem would be solved by the diamond phase retarder, converting the polarization from the horizontal one to the vertical one. In the present experiment, we have performed more practical tests on the NiO sample.

The dd excitations in NiO is measured by non-resonant inelastic x-ray scattering (NIXS). We used a 0.5-mm thick diamond, having a 220 diffraction axis on the surface, after the Si400 channel-cut crystal monochromators. From the intensities of air scattering, monitored by two scintillation detectors, which were mounted in the horizontal and the vertical axes before the sample, we obtained the $P_L$ of 0.85 at 12.7'' offset. The transmission for the diamond is 66 % for 9.89 keV x-rays. Recent experimental and theoretical studies report that NiO has strong dd- (intra-atomic) excitations at 1.0, 1.7, and 3.0 eV. Our previous experiment had a problem in measuring their q-dependent behaviors because the intensity was extremely low at q ~ 7 $A^{-1}$.

Figure 1 shows the direction of q vectors while Fig. 2 the raw spectra obtained in this experiment. Anisotropic, q-dependent intensity of the dd excitations are clearly seen without the suppression at q ~ 7 $A^{-1}$. The major features of the dd excitations are (i) they have high intensities at high q's: the 1.7 and 3.0 eV features have the maximum at q = 6~7 $A^{-1}$, but the 1.0 eV feature has it at 8~9 $A^{-1}$, (ii) they generally have high intensity along low symmetry axes: particularly, the 1 eV feature appears only along quite low-symmetry axes. More **q** points will be measured in near future to obtain finer information. We thank M. Suzuki, S. Goto, M. Takata, and T. Ishikawa for lending us a diamond crystal and for their useful inputs for the installation.

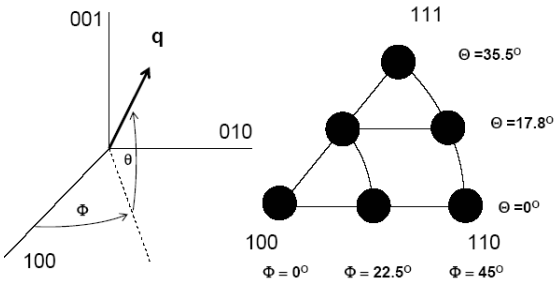


**Fig. 1:** Stereograph of measured directions

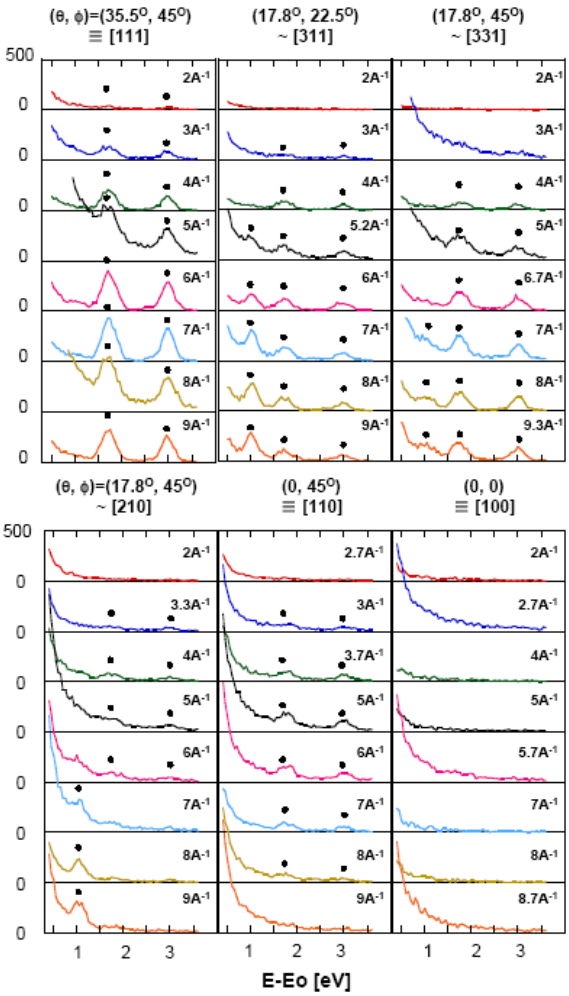


**Fig. 2:** NIXS spectra as a function of q