15. UTILIZATION OF SYNCHROTRON RADIATION

15.4.1. NEAR-EDGE FINE-STRUCTURE OF LOW-Z ELEMENTS BY INELASTIC SCATTERING OF 5-20 keV SYNCHROTRON X-RAYS. By W. Schülke and H. Nagasawa, Institute of Physics, University of Dortmund, Fed. Republic of Germany

The structural information that can be extracted from the near-edge fine-structure will make synchrotron X-ray photoabsorption measurements a valuable tool for in-situ investigations of structural changes under special conditions (temperature, pressure) and environments (substances, gases, fluids, anvils). But, till now, it was both these environmental conditions and the necessity of bulk specimens that prohibited measurements of edges of low-Z elements being done in this kind of experiments. It has been shown experimentally that the edge structure of Li- and Be-metal and of carbon in graphite, as obtained with 1 eV resolution by means of inelastic scattering of 6-keV synchrotron X-rays, is identical to the corresponding VUV-absorption edge, where the momentum transfer q of the scattering experiment plays the role of the polarization vector of the absorption measurement. Thus in-situ investigations of the near edge fine structure of low-Z elements become feasible under conditions, where both the photoabsorption of VUV-radiation by the environmental elements and bulk specimens would prevent VUV absorption measurements. The detection sensitivity is estimated in the light of forthcoming new dedicated synchrotron X-ray sources.

15.4.2. THE INTERFERENCE FRINGE DUE TO X-RAY RESONANT SCATTERING. By H. Yoshizawa, T. Kawanura, K. Ehara, T. Nakanishi**, H. Sugawara, T. Fukamachi and K. Hayakawa***. The Saitama Institute of Technology, *Department of Physics, Yamashina University, ** Photon Factory, National Laboratory for High Energy Physics, ***Advanced Research Laboratory, Hitachi Ltd., Japan.

The fringe caused by the interference between the incident and diffracted x-rays is observed for a perfect crystal in the Laue case, which is known as Pendellösung. It has been observed in the diffraction pattern for a wedge-shaped crystal (N. Kato and A. R. Lang; Acta Cryst., 32, 797 (1979)) and in the diffracted intensities as a function of the incident x-ray wavelength (T. Takama, M. Waseda and S. Sato; Acta Cryst., B36, 1025 (1980)). We have studied theoretically another type of interference fringe which is caused by change of the real part (f'(W)) of x-ray anomalous scattering factor around the absorption edge (T. Kawanura, H. Yoshizawa, T. Fukamachi and H. Sugawara; SRL Rep., 85-02, 36 (1985)).

In this paper, we report on the experimental results of the intensity modulation in the integrated reflection intensity. We measured the energy-dispersive integrated reflecting intensities by using synchrotron radiation at Photon Factory in National Laboratory for High Energy Physics, Japan.

The samples are GaAs perfect crystals of 150 and 200 μm thickness. Figs. 1 and 2 show the results of 200 reflection intensities near the Ga K absorption edge. The open circles are measured intensities and the solid lines are the calculated ones. The calculation is based on dynamical theory of x-ray diffraction with absorption effect into account. The result in each figure shows the intensity modulation in the integrated intensity by the interference as a function of $f'_{Ga}(W)$ through the change of energy around the edge. Two peaks in the intensity curve for a crystal of 200 μm thickness are clearly observed both in theory and experiment. The intensity modulation in the integrated intensity by the interference is a function of $f'_{Ga}(W)$ and $f'_{Se}(W)$. These experimental results confirm that the interference fringes are due to x-ray resonant scattering.

![Fig. 1](image1)

**The integrated reflecting intensities of 200 from GaAs crystal near the Ga K absorption edge. The thickness is about 150 μm.**

![Fig. 2](image2)

**The integrated reflecting intensities of 200 from GaAs crystal near the Ga K absorption edge. The thickness is about 200 μm.**