ANOMALY IN COSTER-KRONIG EFFECT IN CONNECTION WITH RESONANT RAMAN SCATTERING OF X-RAYS

A.Kodre, B.Ajlec and M.Hribar

J. Stefan Institute, E. Kardelj University of Ljubljana, Yugoslavia

In scattering of X-rays on atoms Sparks discovered an inelastic process at the energy of incident photons just below (~100 eV) the K absorption edge of the target atoms. The process was named resonant Raman scattering of X-rays and was explained with a formation of a virtual vacancy state in the K-shell that immediately decays with emission of another photon. The process turns into the well known X-ray fluorescence when the incident photon energy is raised above the K-edge and the vacancy state becomes a real quasistationary state. Craseman et al demonstrated that the virtual state can also decay in a non-radiative way - what has become known as a Raman-Auger effect.

To investigate the interaction of subshells in Raman scattering we studied the fluorescence of uranium in the vicinity of L_2 - absorption edge using a Bragg monochromator with the linewidth of 160 eV for the incident beam and an intrinsic Ge detector to analyze the spectrum of outgoing radiation. Intensities of various fluorescent lines were normalized to the intensity of the elastic scattering peak. The lines originating from the L_2 subshell were found to fade out with incident photon energy decreasing across the L_2-edge in accord with the theory. The lines originating in L_3-subshell exhibit a small stepwise decrease explained with the fading out of the contribution of L_2-L_3 Coster-Kronig transitions. Yet the step seems to be displaced by ~100 eV to that of L_2-lines and is accompanied by a small peak in intensity centered just at the energy of the edge. The possible theoretical explanation calls either for interference of ejected Raman and Coster-Kronig electrons or for phase interaction of reaction channels as outlined by Baz for the case of nuclear processes.