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Reflecting Electron Energy Loss Spectroscopy Study of Fe, Ni and Fe-Ni Compounds

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Experimental inelastic scattering cross sections of Fe, Ni and their compound from reflection-electron-energy-Loss spectroscopy (REELS) spectra are presented. Quantitative analysis of REELS spectra were carried out by using Tougaard-Yubero QUEELS-ε(k, ω)-REELS software [1]. Theoretical inelastic scattering cross section K_{SC} from simulated energy loss function (ELF) and experimental inelastic scattering cross section from REELS spectra at four primary electron energies of 500eV, 1000eV, 1500eV and 2000eV have been investigated. Theoretical inelastic scattering cross section determined through a dielectric-response of solid-electron interaction using Drude-Lindhard oscillator were compared with experimental inelastic scattering cross section from REELS spectra. The peak position, strength and width of oscillators also were determined quantitatively for these materials. Plasmon and interband transition peak appear in energy loss below 50 eV for Fe, Ni [2] and Fe-Ni compounds. Excitation of 3s and 3p contributed in energy loss above 50 eV for Fe and Fe-Ni compounds, for Ni only excitations of 3p occur in this region. Good quantitative agreement is found between the theoretical predictions and the experimental findings for the inelastic scattering cross section. The theoretically calculated inelastic mean free path (IMFP) is found to depend on both primary energy and the amount of Fe in compounds. The IMFP increases with increasing the primary energies and decreases with reducing the amount of Fe in compounds.

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