

19. ELASTIC NUCLEAR RESONANCE BACKSCATTERING SPECTROMETRY (BROAD RESONANCES)

V. I. Soroka

The possibilities of using of the elastic nuclear resonance backscattering of ions for the investigation of materials are analyzed. Broad resonances having the cross-section varying smoothly in large energy range are considered. Under this condition the simplicity of information extraction inherent in the Rutherford backscattering technique is retained. Concurrently, the detection sensitivity for low-mass impurities is improved. The elastic nuclear resonance scattering reaction is always accompanied by the Coulomb and potential scatterings. The above components of the elastic scattering are coherent and therefore interfere. This distinction of the reaction of this type is also revealed in applying resonant scattering for materials analysis. Depending on level parameters of the compound nucleus the interference may be constructive (the cross-section is boosted) or destructive (the cross-section is attenuated). To improve the sensitivity the resonant scattering by impurity nuclei is used in the first case while in the second case the resonant scattering by substrate nuclei is applied (to decrease the background). The physical principles are confirmed by the examples of the impurities investigation of nitrogen in beryllium and oxygen in silicon.