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Basic Study of Quantitative Ion Scattering Spectroscopy.

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Basic problems of quantification by ion scattering spectroscopy (ISS), energy dependency of the detection efficiency of a micro-channel plate(MCP) and neutralization probabilities, have been studied by using a newly constructed TOF-ISS apparatus. It has been clearly revealed for primary ion energy below keV; (1) marked dependence of the detection efficiency of MCP on the signal energy, and (2) strong contribution of those neutral signals to ISS-spectrum that are backscattered through the collision with the second atomic layer atoms. It has been also pointed out that energy dependency of the detection efficiency is described very well by a simple statistical treatment of secondary electron generation in the detector. (3) The detection efficiency curve has enabled the neutralization probability of signal ions to be obtained, leading to the first direct confirmation that matrix effect hardly exist in the Cu-Pt alloy system for ISS-quantification. (4) TOF-ISS measurement with the ions plus neutrals detected as signal has revealed that the neutrals bring about information on the chemical composition of the second atomic layer. Since normal ISS operation provides the information on the chemical composition of the outermost(first) atomic layer to be assessed, leading to another novel approach of practical importance for depth profiling of the top surface region.