

Abstract

In this work the improvement of the data acquisition and processing at the 2 MeV-Hamburg proton microprobe is described. Apart from the development of a new measurement data acquisition electronics optimised for the proton microprobe that uses a programmable logic device and a standard interface to the measurement computer, a new scheme for automatic proton beam focussing is presented. The central points of this work are the improvement of the software for data acquisition and processing, and the development of a new data analysis program. The corrective calculations for the analysis of semi-thick and thick targets have been included as well as a fit that adjusts all parameters (lines with low-energy tailing, energy scale, line width, pile-up correction, escape peaks, reference peak, noise background, bremsstrahlung background and absorber transmission) simultaneously. Another development during this work is the parameterisation of the most important PIXE tabular data (stopping power, ionisation cross sections, fluorescence yields and mass attenuation coefficients) for all elements with a small set of parameters, the tabulation of the necessary element data and the detector specific calibrations and their automatic processing by the software. Finally, the contributions to the application of the proton microprobe in different fields are presented. It is demonstrated in which way the data acquisition, processing and analysis can serve as tools in various applications (e.g. in geology or in the analysis of heavy metal load or the pigmentation of bird's feathers) or for the common improvement of the measuring method, and can open completely new fields of application for the proton microprobe.