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EXAMINATION OF AN ARCHAEOLOGICAL ATTIC CERAMIC FRAGMENT BY 3D MICRO PIXE – A NEW ANALYTICAL TECHNIQUE FOR DEPTH RESOLVED ELEMENTAL ANALYSIS

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3D Micro Particle Induced X-ray Emission (3D Micro PIXE) provides a novel method to look into the depth of a sample by combining an ion microprobe and X-ray spectroscopy. This experimental technique is realized by using an X-ray optic in front of the detector, thus creating together with the focused proton micro-beam in a confocal arrangement a probing volume. By moving the sample through this probing volume depth resolved measurements become possible. In particular, when different elements are present in separate layers having a small thickness in the micrometer regime, 3D Micro-PIXE reveals a powerful potential for resolving the elemental distribution among different layers.

For the experimental realization of this technique, the nuclear microprobe of the Jožef Stefan Institute was used [1] in order to establish, characterize and apply the confocal setup for 3D Micro PIXE [2].

As an application example of this new analytical technique, an archaeological ceramic fragment was examined. The sample is an attic ceramic small fragment (TH/CL-AKROP-34, 5cent. BC, Makrygianni, Acropolis), recently (2000-2003) excavated at the Akropolis area in Athens and dated back to the Classical period. In principle, the fragment consists of two basic layers, one black gloss layer on the top with a typical thickness ranged between 20 - 25 μm fairly well adhered to a second layer, the ceramic porous body. This depth layer composition was investigated with a 3D Micro PIXE setup at the Jožef Stefan Institute in Ljubljana. For the excitation of the sample a 3 MeV proton beam was used having a FWHM of 3 μm in diameter. With this sample we show the potential of the new method to provide direct three-dimensional information on the elemental distribution.

ENDNOTES

1. P. Pelicon, J. Simčič, M. Jakšić, Z. Medunić, F. Naab, and F.D. McDaniel, Nucl. Instr. and Meth. B 231, 53 (2005).
2. A. G. Karydas, D. Sokaras, C. Zarkadas, N. Grlj, P. Pelicon, M. Žitnik, R. Schütz, W. Malzer, and B. Kanngießer, J. Anal. At. Spectrom., 22, 1260 (2007).