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P47 - Simultaneous micro-PiXE and micro-EBS analysis applied to XVI century silver and copper coins

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A coin database containing information about major, minor and trace elements contents and correlation to different eras is an essential tool in: reconstructing the metal and monetary circulation; detecting forgeries; and recognition of different metallic surface enrichment processes.

Ion Beam Analytical (IBA) techniques like Particle Induced X-ray Emission (PIXE) and Elastic Backscattering Spectrometry (EBS) play an important role in the construction of this database as they are non-destructive and can determine the coin chemical composition fingerprint down to the ppm range, which in some cases can be related with the ore provenance or the metal purification process. However, surface inhomogeneities (thickness and composition) created by centuries of corrosion growth may hinder a proper quantitative analysis unless a micro beam is used, which allows us to select small regions with different degrees of corrosion.

Using 1.0 and 2.0 MeV proton beams from the nuclear microprobe (resolution $3 \times 4 \mu\text{m}^2$) located at the Laboratory of Accelerators and Radiation Technologies at CTN (Sacavém - Portugal), micro-PIXE and micro-EBS spectra were taken simultaneously, for two copper and four silver XVI century Portuguese coins. 2D-PIXE maps were acquired for all coins, followed by point analyses in selected regions with higher or lower corrosion extension.

A self-consistent solution is hard to reach analysing the PIXE and EBS spectra with separate software tools, as for these coins a single PIXE or EBS spectrum is not enough to obtain a unique solution describing a concentration profile changing with depth. Thus, a simultaneous analysis of these spectra was performed using DataFurnace software [1] which allowed differentiating the superficial corrosion layer from the uncorroded volume underneath. Grazing incidence XRD was also performed on these coins in order to identify the compounds present in the corrosion layer, namely oxides, carbides, etc, and that were used as input for DataFurnace.

The results obtained using this simultaneous fitting procedure are presented and compared with the results obtained when fitting only the PIXE spectra.

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[1] C. Pascual-Izarra, M. Reis, N. Barradas, Nucl. Instr. and Meth. B 249 (2006) 780.

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