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P54 - Micro-PIXE and micro-NRA: associated tools for materials characterization

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Ion-based analytical techniques are widely used for modification, characterization and analysis of materials. One of the motivations for the continued development and application of these techniques part of its high sensitivity for determining and quantifying trace elements in the order of parts per million (ppm), and create images of their distributions and depth profiles.

The elemental characterization of homogeneous samples is performed in, general, by combining two complementary techniques: PIXE (Particle Induced X-ray Emission) and RBS (Rutherford Backscattering) with stationary beams of the order of mm2. However, when there are structures in the sample surface and differences in its elemental distribution, we should use the scanning microprobe system, where the beam spot size is reduced to the order μm2. Micro-PIXE provides the spatial distribution of elements with Z> 12, while micro-RBS allows the study of multilayered samples with good selectivity for thin layers of heavy elements on light elements substrates.

Despite having lower cross sections, the technique of nuclear reaction analysis (NRA - Nuclear Reaction Analisys) can also be used in the microprobe system. The positive point is that through NRA is possible to determine light elements and their isotopes on any substrate.

This study shows the possibility of associating micro-PIXE and micro-RNA for elemental characterization of materials. As an example, we present the elemental characterization of a human hair. Samples were irradiated at the Laboratório de Implantação Iônica (IF-UFRGS) with the 3MV tandem accelerator. Proton beams with energy of 1,75 MeV were selected for analysis of particular micro regions of the hair sample with micro-PIXE and micro-NRA. The selected regions were scanned with focused proton beam of 4 - 5 μm spot size and currents of ~80 pA. The size of the scan was 200 μm x 200 μm.

Through the micro-RNA was possible to determine the presence of carbon in human hair, while micro-PIXE showed the presence of elements such as S, K, Ca and Zn, which are in agreement with other studies [1].

[1] C.A. Pineda-Vargas, M. E. M. Eisa; Nucl. Instrum. Methods Phys. Res., Sect. B 268 (2010) 2164-2167.

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