

Nuclear microprobes in biomedicine and environment: technical developments and applications

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Despite the fact that a lot of efficient analytical and chemical imaging techniques have been extensively developed in bio labs and at worldwide facilities for applications in biomedicine nowadays, microanalysis based on elemental mapping at ppm level of sensitivity and on a micron or submicron scale remains a challenge. Among those techniques, a few of them have proved their capability to measure trace elements and to deliver tissue images with sub-micrometer resolution, both rapidly and non destructively, authorizing the localization of cellular structure. Even though routine sound applications are steadily developed at our facilities, one can reasonably question the future of this technique when compared to SIMS, Synchrotron Radiation nanofocussed X-ray beams or even Immuno-labelling combined with fluorescent probes in the optical visible wavelength. Hopefully, the versatility of nuclear microprobes, the possible quantification in absolute mode and the easy access to the instrument, even with the support of transnational European Actions [1], are still strong arguments for the use of nuclear microprobes. The combination of high resolution proton microbeams with PIXE, RBS, STIM in 2D or 3D mode offers a large panel of analytical possibilities.

New fields have been opened during the last decade. In plant biology, remediation of polluted soils in the environment, including radioactive species gave rise to new applications. After the pioneering work of the FP5 consortium NANODERM [2], Nanotoxicology is now an active domain of research where studies in cultured cells or multicellular organisms exposed to artificial nanoparticles are becoming widespread. On a technical point of view, sample cryo-preparation techniques have been implemented and first cold stages, aiming at limiting sample damages, have been installed in end-stations of microbeam lines. Real applications of PIXE-Tomography in biological samples have been obtained. The aim of this talk is to present a review covering new technical progress and achievements in Biology and Environment.

[1] SPIRIT (www.spirit-ion.eu)

[2] NANODERM (www.uni-leipzig.de/~nanoderm/)