

Skin morphology and layer identification using different STIM geometries

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The use of on-axis geometry in Scanning Transmission Ion Microscopy (STIM) has been widely used for thin biological sample structure identification. In this configuration, the lateral resolution is optimised so that micron or sub-micrometer beam spot are easily achieved even for classic microbeam lines. Off-axis STIM was more particularly employed for normalising elemental contents obtained by other ion beam analysis techniques in organic thin samples. Due to the very small beam current required, on-axis STIM is a stand-alone technique. Off-axis STIM can be advantageous as it enables the simultaneous utilisation of PIXE and RBS techniques.

In this paper, the STIM images obtained with an on-axis geometry, a standard off-axis geometry and a recently developed on-off geometry [1] are presented and discussed. Data from skin samples are used for comparison purposes aiming at studying skin permeability to sunscreens. Skin is a stratified tissue and the precise identification of skin layers is needed to ascertain the penetration depth of the physical filter from the formulation. Transmission Electron Microscopy reference images are also included in this study with the purpose of contributing to the epidermis structure elucidation.

In addition to the intrinsic difference in image quality due to the beam resolution, the influence of the detector type, implanted silicon detector versus Si pin diode, is discussed on the basis of their energy resolution, their resistance to beam damage as well as the effect of the sample thickness in the final image obtained. Data reduction and software is also presented for the different geometries and the effect of parameters such median or mean energy on the image quality is shown.

[1] Jan Pallon, et al., Nucl. Instrum. and Meth. B (2004) in press.