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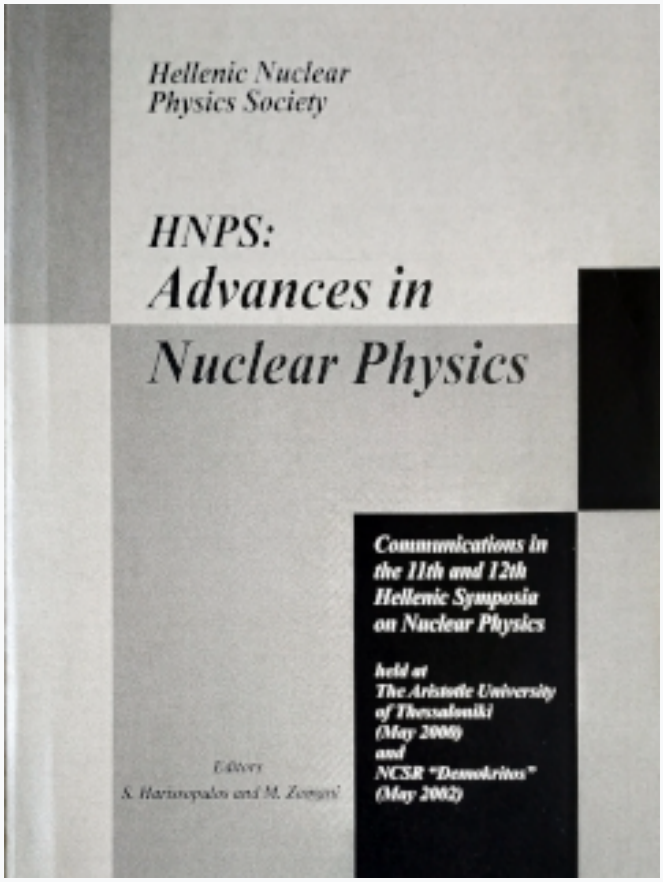

Analysis of Ancient Glass Using Ion Beams and Related Techniques

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Analysis of Ancient Glass Using Ion Beams and Related Techniques.

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Abstract

Ion Beam Analysis (IBA) techniques are established as an indispensable tool for material analysis. They are very powerful when applied to the examination of uniform layers. In recent years they have been also used for the quality control of implanted layers, which improve the mechanical or chemical properties of common materials. The use of IBA techniques for the study of corrosion is impeded by the non-uniformity of such layers, which renders the analysis difficult. In the Material Analysis Laboratory of the Institute of Nuclear Physics, a combination of experimental techniques and analytical algorithms has been developed, which allows the non-destructive examination of corrosion layers on cultural artifacts.

Ancient glass fragments from Kenchreai, Greece, were analyzed with ion beam techniques, in order to examine the applicability of the latter to the characterization of the surface. The relative distribution of heavy components was determined by X-Ray Fluorescence (XRF). Nuclear reactions were used to determine the depth distribution of H, O, C and Si. The Hydrogen distribution rises sharply from the surface, reaching a maximum of 9×10^{22} at/cm^3 at 0.5 μm and then decays smoothly to a depth of approximately 2 μm. Examination of the same samples with α-particles, indicates a depletion of Silicon in the same surface region, while the Oxygen distribution is uniform. A detailed analysis, using the ^{28}Si(p, p) reaction, which resonates at 2.095 MeV, confirms the depletion and other non-uniformities in the Silicon distribution.