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Introduction: Although Synchrotron Radiation X-Ray fluorescence (SR-XRF) is among the least destructive analysis methods applied to rare extraterrestrial grains, we have observed radiation damage effects following high flux synchrotron analyses. Track 30 of the IS collector of the Stardust mission [1], containing 2 candidates dubbed Orion and Sirius [2] was analyzed at ESRF, France, on beamlines ID13 and ID22NI by nano-XRF/XRD scanning methods. Beam damage effects were noticed on both samples and a quantitative analysis of their irradiation history was established [3], allowing us to propose new experimental protocols as well as fluence limits, minimizing such effects in the future. The purpose of this study is to present these facts, analyze potential damage mechanisms and offer alternatives.

Cosmic irradiation limit: the cosmic X-rays background in the 3 – 300 keV energy range, most likely produced by active galactic nuclei components impacting our IS samples was fitted by a simple analytical expression by Gruber et al. [4] and a limit of cosmic irradiation of $3 \cdot 10^{19}$ ph/cm^2, dubbed Astrophysical Limit (AL) was established. X-ray scanning of IS samples at fluences (flux · time) exceeding the AL are potentially damaging, except in specific cases, known in biochemistry as "recovery effects" appear, where multiple shorter exposures are preferable to long ones [7].

Damage mechanisms: Main particle impact damage include electron or proton/alpha irradiation-induced heating, ion displacement and charging [6, 7] of microscopic samples, particularly material in an insulator matrix.

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