ANALYSIS OF RESIDUES RESULTING FROM MAFIC SILICATE IMPACTS INTO ALUMINIUM 1100

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Introduction: The Al 1100 foils on the Stardust spacecraft had the primary function of securing the aerogels in place, however they also provided an extra surface totaling $153cm^2$ [1] upon which cometary materials may be examined, in the form of impact residues. Their collection will provide flux information for particles ≤1μm in size that cannot easily be found and extracted from aerogel, as well as compositional information on a wide size range of impacting particles.

Earlier work [2] suggests that residues should be plentiful from impacts at Stardust encounter velocities (~6.1km/s), however, little is known about how the materials will have changed during impact. Fully exploiting this unique opportunity requires that we understand the impact process occurring on the foils; and in particular, whether it is possible to distinguish the most important minerals expected within cometary materials.

Experimental Methodology: For this study, a series of light gas gun shots were conducted at the University of Kent, firing magnesium silicate minerals into Stardust foils. An Mg-rich olivine, enstatite, diopside and lizardite were chosen as representative of minerals likely to be contained within comets [3]. Residues from 5 craters for each of these magnesium silicates were then analysed using SEM EDS at the Natural History Museum. As the residue thickness and geometry (a thin sheet on a sloping interior crater wall) differ from the form of conventional microanalysis standards, creating a relatively short matrix absorption pathway, it was not considered appropriate to use the matrix correction routines used for normal quantative electron microprobe analyses. The raw magnesium and silicon counts were therefore compared against those for their precursor projectiles. The Mg to Si ratio was chosen for comparison as it provides an excellent, but simple means by which to distinguish between these important cometary dust components.

Results and Discussion: A small but systematic increase in Mg counts relative to Si is seen for all residues when compared to projectile compositions. However, in our graphical plots, the minerals remain distinct from one another in both projectile and residue composition. We conclude that the main groups of anhydrous mafic silicates should be easily and reliably distinguishable in EDS analyses taken from within Stardust foil craters, suggesting that a valuable additional collection of cometary materials is available to researchers. We are now extending our study to recognition and in situ analyses of other silicate, sulfide, carbonate and oxide minerals of importance in extraterrestrial samples.

References: [1] Tsou P., Brownlee D. E., Sandford S. A., Hörz F., Zolensky M. E. 2003. *Journal of Geophysical Research (Planets)* 108(E10): 8113, 10.1029/2003JE002109 [2] Bernhard R. P. and Hörz F. 1995. *International Journal of Impact Engineering* Vol. 17. pp.69-80 [3] Hanner M. S. 2003. In: Henning T. (ed.) *Astromineralogy.* pp. 171-188.