ELEMENTAL ANALYSIS OF IMPACT RESIDUES IN CRATERS ON THE STARDUST INTERSTELLAR FOILS.

R. M. Stroud, C. Allen, A. Asnari, S. Bajt, N. Bassim, H. A. Bechtel, J. Borg, F. Brenker, J. Bridges, D. E. Brownlee, M. Burchell, M. Burghammer, A. L. Butterworth, P. Cloetens, A. M. Davis, R. Doll, C. Floss, G. J. Flynn, D. Frank, Z. Gainsforth, E. Grün, P. R. Heck, J. K. Hillier, P. Hoppe, L. Howard, G. R. Huss, J. Huth, B. Hvite, A. Kearsley, A. J. King, P. G. Kotula, B. Lai, J. Leitner, L. Lemelle, A. Leonard, H. Leroux, L. R. Nittler, R. C. Ogliore, W. J. Ong, F. Postberg, M. C. Price, S. A. Sandford, J. A. Sans Tresseras, S. Schmitz, T. Schoonjans, K. Schreiber, G. Silversmit, A. Simionovici, R. Srama, T. Stephan, J. Stodolna, S. R. Sutton, R. Toucoulou, M. Trieloff, P. Tsou, A. Tsuchiyama, T. Tyliczszak, B. Vekemans, L. Vincze, A. J. Westphal, M. E. Zolensky, and >29,000 Stardust@home dusters. ISPE author affiliations are at http://www.ssl.berkeley.edu/~westphal/ISPE/.

Introduction: Preliminary imaging studies show the abundance of craters on the interstellar foils is 50 to 100 times the expected value for interstellar particle impacts [1]**.** Thus, the majority of the craters are likely due to other sources, such as secondary impacts from interplanetary dust particles that impacted the solar panels, or direct impact of high velocity nanoparticles.

In order to distinguish amongst the possible origins for the craters, elemental analyses of any retained impact residue, and/or crater morphology measurements, are necessary. Solar cell cover glass is primarily silica, but contains wt. % levels of Ce and Zn, which can be used as an indicator of spacecraft origin. The specific features of craters from the impact of high velocity nanoparticles, i.e., 10–50 nm particles traveling at 100–400 km/s, are unknown, however, lack of detectable residue and/or high depth-to-diameter and narrow-rimmed craters are expected to be diagnostic. Results from analog shot studies suggest that interstellar particle impact craters are likely to contain residue detectable by Auger spectroscopy, and have crater morphologies consistent with impact velocities of 5–25 km/s.

Experimental: Elemental analysis of six craters was performed, including those with symmetric and asymmetric geometries, and both larger and smaller than 1 μm. Auger measurements were done with the PHI 700 Auger Nanoprobe at Washington University [2]. EDX measurements were performed at the MPI for Chemistry in Mainz using a FEG SEM with a conventional EDX system, and at Sandia National Lab, NM, using a FEG SEM with a custom Bruker on-axis silicon drift-detector EDX system. FIB-TEM studies were carried out at the Naval Research Lab, with a FEI Nova 600 FIB-SEM and JEOL 2200FS TEM**.**

Results and Discussion: All six craters contained residues with levels of Si and O dectectable by Auger or EDX, but not Ce, or Zn. In addition, Fe was detected in four craters, Mg in two, and Na in two. Subsequent TEM analysis of FIB sections from two craters first analyzed by EDX revealed residues ~ 10-50 nm thick, with major silica and minor levels of Ti, Ce and Zn. These measurements are consistent with analysis of tracks in aerogel from the IS collector, which revealed ~ 80% of tracks originate from secondary impacts. Additional elemental analysis of craters is planned to identify bona fide interstellar particle impacts.

References: [1] Stroud R. M. et al. 2011. *Lunar Planet. Sci. XLII*, #1753. [2] Floss C. et al. 2011. *This Volume*.