COMPOSITIONAL DETERMINATION OF SURVIVING MATERIAL IN STARDUST ANALOG AL-FOIL CRATERS. T. K. Croat[1], B. A. Haas[1], C. Floss[1], and M.J. Burchell[2]. [1]Laboratory for Space Sciences and Physics Dept., Washington University, St. Louis, MO 63130, USA. tkc@wustl.edu. [2]Centre for Astrophysics and Planetary Science, School of Physical Sciences, Univ. of Kent, Canterbury UK.

Introduction: Whereas Al foils were not considered to be a primary collection medium on the NASA Stardust mission to comet 81P/Wild 2, and were later used primarily only for isotopic analyses [1], recent FIB-TEM results on Stardust analogs show better than expected preservation of material; submicron moderately refractory grains are found as intact, faceted crystals after capture [2]. This suggests that Al-foil craters have some potential for chemical and even structural studies of Wild 2 grain populations. We report results from SEM-EDX (and subsequent FIB-TEM studies in [3]) of a Stardust-analog foil that was made by firing Acfer 094 primitive matrix at Al foil using a light gas gun [4]. Through comparison of the Acfer 094 matrix grain population with the same material after Al-foil capture, we develop here the spectral analysis techniques needed to make more accurate SEM-EDX compositional determinations, which can enable subsequent targeted FIB-TEM studies of Wild 2 craters [5,6].

Experimental Methods: Acfer 094 matrix was shot at Al 1100 foil at 6.05 km/s (≈ the cometary encounter speed) with a two-stage light gas gun [4]. The resulting foil craters (N=135, with diameters from 0.5 to 8 µm) were examined with SEM-EDX to characterize surviving projectile material in the craters (the raw projectile material was also characterized). SEM-EDX spectral analysis procedures for the Al-dominated crater spectra were developed using custom software (Microcal OriginLab). FIB-TEM studies of 12 craters are presented in [3], and TEM-EDX composition determinations of the same craters were used to derive k-factors for SEM-EDX for Mg, Si, S, Ca, Fe and Ni.

Results and Discussion: Even with short acquisition times, surviving Acfer 094 material was detected in ~85% of the Al foil craters. After adequately correcting for the large Al peak overlap on Mg, SEM-EDX can determine the average composition of the surviving material to within ± 5 at. % (for Mg, Fe and Si; calibrated against TEM-EDX studies of the same craters). Al (which comprises ~5 at. % of Acfer 094 matrix) must be excluded, but the Al foil samples do allow for more accurate Si quantization unaffected by the Si contamination from melted SiO_2 that occurs in fine-grained aerogel samples. The SEM-EDX compositions suggest Acfer 094 craters were created primarily by amorphous silicate, pyroxene, and sulfide grains. Fewer craters are mixtures of silicates and sulfides relative to Wild 2 (~5% as opposed to ~50% in Wild 2), which may indicate a coarser grain size distribution for Acfer 094 or perhaps fragmentation of fine grained aggregates upon firing. The ability to accurately estimate surviving grain compositions from crater SEM-EDX can enable rapid surveys of large numbers of Wild 2 craters to identify small fragments of CAIs or other refractory grains for targeted FIB-TEM studies.

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