

GENESIS SOLAR WIND ARRAY COLLECTOR CATALOGING STATUS. P. J. Burkett¹, M.C. Rodriguez², M.C. Calaway¹, J.H. Allton³: (1) Jacobs (ESCG) at NASA Johnson Space Center, Houston, TX; (2) Geocontrol Systems (ESCG) at NASA Johnson Space Center, Houston, TX; (3) NASA, Johnson Space Center, Houston, TX; patti.j.burkett@nasa.gov.

Introduction: Genesis solar wind array collectors were fractured upon landing hard in Utah in 2004. The fragments were retrieved from the damaged canister, imaged, repackaged and shipped to the Johnson Space Center curatorial facility [1]. As of January 2009, the collection consists of 3460 samples. Of these, 442 are comprised into “multiple” sample groupings, either affixed to adhesive paper (177) or collected in jars (17), culture trays (87), or sets of polystyrene vials (161). A focused characterization task was initiated in May 2008 to document the largest samples in the collection. The task consisted of two goals: to document sapphire based fragments greater than 2 cm in one dimension, and to document silicon based fragments greater than 1 cm in one direction.

| <u>Sapphire-based</u> | <u>Abbreviation</u> |
|--------------------------------|---------------------|
| Aluminum-on-sapphire | AIOS |
| Gold-on-sapphire | AuOS |
| Silicon-on-sapphire | SOS |
| Sapphire | SAP |
| Carbon-cobalt-gold-on-sapphire | CCoAuOS |
| <u>Silicon-based</u> | |
| Float-zone silicon | Si-FZ |
| Czochralski silicon | Si-CZ |
| Diamond-like carbon on silicon | DOS |

Cataloging technique: Samples are handled cleanly with stainless steel tweezers for initial extraction from Utah packaging. Solar wind regime (spacecraft array location) is determined by measuring fragment thickness on a Mitutoyo digimatic indicator.

| <u>Solar Wind Regime</u> [2] | <u>Array Location</u> |
|------------------------------|-----------------------|
| Bulk | B/C |
| Coronal Mass Ejection | E |
| High Speed | H |
| Low Speed interstream | L |

If the fragment is silicon-based, an FT-IR (Fourier transform infrared spectroscopy) is used for interferogram analysis to differentiate FZ and CZ silicon species. Lastly, an overview image is taken of the fragment to document basic surface condition using a Leica MZ9 stereomicroscope. Length, width, and area measurements are processed outside of the lab using Canvas X image analysis software.

Table 1: Collector distribution by sample area, material, and array (regime). Data as of January 2009.

| MATERIAL AND REGIME | TOTAL SAMPLES | ≤100 mm ² | 101 - 299 mm ² | ≥300 mm ² |
|---------------------|---------------|----------------------|---------------------------|----------------------|
| AIOS | 104 | 20.2 % | 52.9% | 26.9 % |
| B/C | | | | |
| AIOS E | 42 | 9.5 % | 47.6% | 42.9 % |
| AIOS H | 39 | 17.9 % | 43.6% | 38.5 % |
| AIOS L | 23 | 13.0 % | 43.5% | 43.5 % |
| AuOS | 88 | 25.0 % | 47.7% | 27.3 % |
| B/C | | | | |
| AuOS E | 73 | 8.2 % | 47.9% | 43.8 % |
| AuOS H | 64 | 9.4 % | 46.9% | 43.8 % |
| AuOS L | 26 | 11.5 % | 61.5 % | 26.9 % |
| SOS B/C | 79 | 30.4 % | 38.0 % | 34.2 % |
| SOS E | 42 | 7.1 % | 47.6 % | 40.5 % |
| SOS H | 34 | 2.9 % | 38.2 % | 50.0 % |
| SOS L | 32 | 6.3 % | 53.1 % | 37.5 % |
| SAP B/C | 23 | 47.8 % | 26.1 % | 26.1 % |
| SAP E | 35 | 20.0 % | 37.1 % | 42.9 % |
| SAP H | 28 | 10.7 % | 39.3 % | 50.0 % |
| SAP L | 14 | 28.6 % | 50.0 % | 21.4 % |
| CCo-AuOS | 6 | - | 66.7 % | 33.3 % |
| B/C | | | | |
| Si B/C | 15 | 93.3 % | 6.7 % | - |
| Si E | 8 | 87.5 % | 12.5 % | - |
| Si H | 28 | 60.7 % | 39.3 % | - |
| Si L | 2 | 100.0 % | - | - |
| Si-FZ B/C | 111 | 94.6 % | 5.4 % | - |
| Si-FZ E | 42 | 95.2 % | 4.8 % | - |
| Si-FZ H | 27 | 88.9 % | 11.1 % | - |
| Si-FZ L | 24 | 95.8 % | 4.2 % | - |
| Si-CZ | 64 | 95.3 % | 4.7 % | - |
| B/C | | | | |
| Si-CZ E | 36 | 83.3 % | 16.7 % | - |
| Si-CZ H | 29 | 86.2 % | 13.8 % | - |
| Si-CZ L | 42 | 90.5 % | 9.5 % | - |
| DOS B/C | 48 | 97.9 % | 2.1 % | - |
| DOS E | 26 | 100.0 % | - | - |
| DOS H | 18 | 94.4 % | 5.6 % | - |
| DOS L | 16 | 93.8 % | 6.3 % | - |

Final images for the catalog are labeled with sample number, material, and array designation (Fig.1).

Catalog Results: Table 1 illustrates a size distribution of the cataloged samples by fraction of sample area, within each material and regime. There are specific exclusions to this presentation (not all of the collection has been evaluated for regime/area measurement), but it is useful in estimating samples available for allocation. The percentage of the collection represented by these exclusions is 57% by numbers of samples (many small fragments are not represented). Nevertheless, a substantial percent of area has been cataloged (Table 2).

The total collector material on the Genesis spacecraft was 1,672,944 mm² (not including germanium collectors). Total percentage of cataloged array material by area is 18% (as of January 2009).

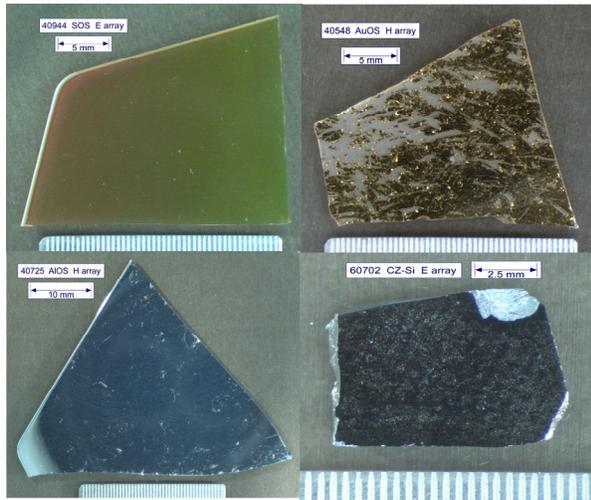


Fig. 1. Examples of cataloged array fragments (clockwise from upper left): SOS with clean, unscratched surface, AuOS with a heavily scratched surface, AIOS with minor scratches on surface, CZ-Si with dusty surface. SOS and AuOS have 5 mm scale bars, AIOS has a 10 mm scale bar, and CZ-Si has a 2.5 mm scale bar.

References: [1] Allton J.H. *et al.* (2005) LPS XXXVI, Abstract #2083. [2] Burnett D.S. *et al.* (2003) *Spa. Science Rev.*, 105:509-534.

Table 2. Comparison of total flown array collector material to area cataloged. Data as of January 2009.

| MATERIAL | ARRAY | FLOWN AREA (mm ²) | AREA CATALOGED (mm ²) | TOTAL CATALOGED (%) | |
|----------|-------|-------------------------------|-----------------------------------|---------------------|------|
| SAP | B | 25108 | 10976.0 | 21.9 | |
| | C | 25108 | | | |
| | H | 25108 | 12147.4 | | 48.4 |
| | E | 31184 | 15096.6 | | 48.4 |
| | L | 25108 | 2796.6 | | 11.1 |
| SOS | B | 31385 | 33690.2 | 59.6 | |
| | C | 25108 | | | |
| | H | 25108 | 14878.5 | | 59.3 |
| | E | 25108 | 16078.6 | | 64.0 |
| | L | 25108 | 9542.6 | | 38.0 |
| AIOS | B | 31184 | 30110.4 | 42.0 | |
| | C | 40499 | | | |
| | H | 31385 | 14747.8 | | 47.0 |
| | E | 37461 | 16488.8 | | 44.0 |
| | L | 25108 | 7992.7 | | 31.8 |
| AuOS | B | 24907 | 31952.1 | 48.9 | |
| | C | 40499 | | | |
| | H | 62167 | 19060.8 | | 30.7 |
| | E | 43738 | 29398.4 | | 67.2 |
| | L | 43336 | 6744.4 | | 15.6 |
| CCo-AuOS | B | 12353 | 6068.3 | 49.1 | |
| | C | 0 | 0.0 | 0.0 | |
| | H | 0 | 0.0 | 0.0 | |
| | E | 0 | 0.0 | 0.0 | |
| | L | 0 | 0.0 | 0.0 | |
| CZ Si | B | 56493 | 3123.2 | 1.8 | |
| | C | 112986 | | | |
| | H | 43939 | 2219.0 | | 5.1 |
| | E | 56493 | 2415.7 | | 4.3 |
| | L | 56493 | 2426.7 | | 4.3 |
| FZ Si | B | 125540 | 4580.7 | 2.0 | |
| | C | 100432 | | | |
| | H | 106709 | 1846.8 | | 1.7 |
| | E | 106709 | 2412.8 | | 2.3 |
| | L | 138094 | 1192.9 | | 0.9 |
| DOS | B | 18831 | 1502.9 | 4.0 | |
| | C | 18831 | | | |
| | H | 25108 | 523.7 | | 2.1 |
| | E | 25108 | 985.8 | | 3.9 |
| | L | 25108 | 730.4 | | 2.9 |