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Chemical characterization of components that will come into contact with samples from asteroid Bennu at the Sample Curation Facility, Canadian Space Agency

NICOLE M.B. WILLIAMSON[1], PATRICK HILL[1], CAROLINE-EMMANUELLE MORISSET[1], CHRISTINE BROPHY, MSC[2], PATRICIA GRINBERG[2], OVIDIU MIHAI[2] AND ZOLTAN MESTER[2]

[1]Canadian Space Agency
[2]National Research Council Canada

The Canadian Space Agency (CSA) will receive approximately 4.8g of sample material from asteroid Bennu collected as part of the OSIRIS-REx (Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer) mission. Curation of the sample will take place at the CSA in the newly built Sample Curation Facility, which will include Class 100 to 10000 (ISO 5 to 7) clean rooms for cleaning and sample manipulation. In preparation, we are undertaking numerous activities that will create a chemical map of the curation environment. This includes developing contamination monitoring protocols, and the current study, which aims to characterize the elemental content of components that will be used to contain and manipulate Bennu material. Components include sample container parts (e.g., aluminium gaskets, stainless steel (SS) flanges and lids) and manipulation tools such as weighing dishes, scalpels, spatulas, and tweezers. Ultimately, a database of tool chemistry will be created as a reference for contamination control.

Preliminary work was completed on samples from two aluminium gaskets, one SS flange, and two SS lids. Samples were cut at the CSA into subsamples and sent to the Metrology Research Centre, National Research Council (NRC), in Ottawa, Ontario for analysis by Glow Discharge Mass Spectrometry (GD-MS). Concentrations for 77 elements were measured on one to three pins cut from each subsample at the NRC. Results suggest that overall, aluminium samples have lower concentrations of most elements than SS samples. There is a small difference in some elemental concentrations between items of different SS grade (304 vs. 316), however, more data is needed to determine whether one grade of SS should be favoured over another. Compositional heterogeneity in each SS subsample was assessed using data from the subsample pins (n = 3 for each subsample), and results show elemental variations in each subsample. In some cases, the relative standard deviation (RSD) between pins was higher than 50%, and in general, elements with lower concentrations in the subsamples had higher RSDs. Next steps include additional analyses on other components and the possibility of comparing data obtained by GD-MS with another method such as Laser Ablation Inductively Coupled Plasma Mass Spectrometry.