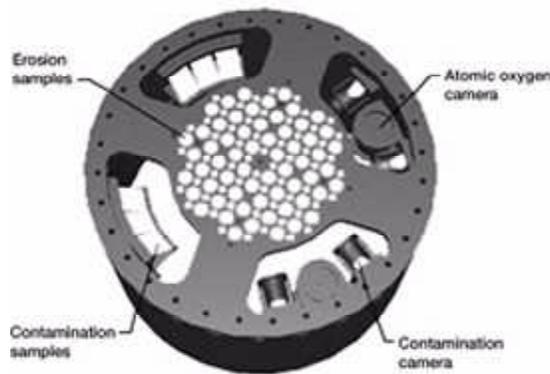


Polymers Erosion and Contamination Experiment Being Developed

The Polymers Erosion and Contamination Experiment (PEACE) is currently being developed at the NASA Lewis Research Center by the Electro-Physics Branch in conjunction with students and faculty from Hathaway Brown School in Cleveland. The experiment is a Get Away Special Canister shuttle flight experiment sponsored by the American Chemical Society. The two goals of this experiment are (1) to measure ram atomic oxygen erosion rates of approximately 40 polymers that have potential use in space applications and (2) to validate a method for identifying sources of silicone contamination that occur in the shuttle bay. Equipment to be used in this flight experiment is shown in the schematic diagram.



Schematic diagram of PEACE showing polymer erosion samples, silicone contamination samples, atomic oxygen pinhole cameras, and contamination pinhole cameras.

Spacecraft materials subjected to attack by atomic oxygen in the space environment experience significant degradation over the span of a typical mission. Therefore, learning the rates of atomic oxygen erosion of a wide variety of polymers would be of great benefit to future missions. PEACE will use two independent techniques to determine the atomic oxygen erosion rates of polymers. Large (1-in.-diameter) samples will be used for obtaining mass loss. Preflight and postflight dehydrated masses will be obtained, and the mass lost during flight will be determined. Small (0.5-in.-diameter) samples will be protected with isolated particles (such as NaCl crystals) and then exposed to the space environment. After flight, the protective particles will be removed (washed off) and atomic force microscopy (AFM) will be used to measure the erosion depth from protected mesas. Erosion depth measurements are more sensitive than traditional mass measurements and are very useful for materials with low erosion yields or with very low fluence missions.

PEACE will validate silicone contamination sources by using special contamination pinhole cameras with views of three different types of silicones. Six silicone samples will be viewed--three with atomic oxygen exposure and three without atomic oxygen exposure. The atomic oxygen interaction with the silicone should result in greater

contamination; this can be validated with the cameras. The contamination cameras will also have a view of atomic oxygen, for atomic oxygen fixing of the contamination. Scanning ellipsometry will be used to produce an image of the source of contaminants. Using pinhole cameras to detect sources of silicone contamination will provide a model for possible use in future shuttle operations.

Three students from Hathaway Brown School spent the 1998 summer at Lewis, and five students worked during the 1998-1999 school year, designing the sample configuration, ordering samples, and learning some of the technical aspects of putting together an experiment. Members of the Electro-Physics Branch and Dynacs Engineering Co., Inc., are overseeing the development of the experiment, the faculty from Hathaway Brown School are coordinating the students' efforts, and the Space Flight Projects Branch is serving as the project manager.

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