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DEVELOPMENT OF SPECIFICATIONS FOR POLYMERIC MATERIALS

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SCOPE

This report covers the work performed during the period July 10 to August 9, 1965 on "Development of Specifications for Polymeric Materials."

The over-all objective of this program is to assist the Jet Propulsion Laboratory in the development and preparation of polymeric material specifications to be used in connection with JPL spacecrafts. The materials to be studied and the extent of work to be performed are specified by the JPL Cognizant Engineer.

WORK PERFORMED

Specification test procedures must be designed to provide quality control of materials which have been found acceptable for spacecraft use and to set standards for new polymeric materials which are candidates for use in spacecrafts. A satisfactory test procedure must force a polymer to incur within a reasonably short time a maximum weight loss (without decomposition) and a steady-state outgassing value. In order to arrive at some idea of the time required, a silicone elastomer (General Electric Co. No. SE-555) was selected for trial runs in the standardized vacuum weight loss unit which has been constructed recently.

The vacuum weight loss unit has been described briefly in Monthly Report No. 13 and will be described in detail in Interim Report No. 1 (dated August 9). The following method of procedure was used for the first experimental run:

Four weighed samples (± 0.02 mgm) of the elastomer (about 1" x 2" x 1/16" each) were suspended in each of four sample chambers pre-heated at 125 °C; evacuation was begun immediately. After 50 hours of exposure to the thermal-vacuum environment, one set of samples was removed and re-weighed; subsequently, the remaining sets were removed in order after 100, 200, and 300 hours. The following results were obtained:

Weight Loss of GE Silicone SE-555 (White)	
Sample: 4 pieces, 1" x 2" x 1/16"	
Conditions: 125 °C and 10 ⁻⁶ torr	
Exposure Period	Weight Loss
50 hr	3.07%
96 hr	3.34%
200 hr	3.12%
306 hr	3.85%

Except for the "off-curve" point at 96 hours (probably due to pick-up of condensed oil from the upper walls of the sample chamber while removing the samples), the increase in loss of weight of the samples does not indicate a trend to leveling off even after as long an exposure time as 300 hours. Therefore, two variations of sample preparation will be made in order to determine whether a steady-state loss rate can be achieved in a shorter period of time by increasing the surface area of the samples:

- (1) Single samples of the same size previously used will be cut into strips about 0.02" wide.
- (2) Single samples will be ground (while frozen with liquid nitrogen) into fine particles.

The analyses of a series of Epon resins (Shell Chemical Co.) for epoxy equivalent, hydrolyzable chloride content, filler content, volatile material, density, and infrared absorbance have been completed and will be presented in detail in Interim Report No. 1. Analysis for amine equivalent of several of these resins has been unsatisfactory; work is underway to complete these analyses.

FUTURE WORK

The vacuum weight loss unit will be run on a continuing basis for the evaluation of polymers.

Chemical analyses will be performed on another series of polymeric materials as selected by the Cognizant Engineer.

Work is well underway on the preparation of Interim Report No. 1; it is anticipated that this report will be issued during the next working period.