SILICON MATERIAL AND JPL WEB TEAM

Ralph Lutwack, Chairman

This session consisted of four presentations on silicon material activities and two presentations describing the efforts of the JPL Web Team.

Union Carbide Corp. described progress in the program to develop fluidized-bed technology for the silane system. Quartz liners used in experimental runs continue to fail on cool-down. A modified reactor has been designed to permit the use of commercially available quartz tubes and to improve the liner seals. Experiments with the new reactor will be done during the contract extension (ending December 31, 1985). Improvements in the cleaning procedure for the seed material were indicated by the purity measurements. In a 110-h run at a silane concentration in the range of 20 to 30% in H_2, several kilograms of product were obtained. A layered structure of the particles was found using scanning electron microscope (SEM) analyses.

Washington University at St. Louis reported on the development of a model of the silane fluidized-bed system. The sensitivity of the model predictions to the reaction kinetics and to the grid design parameters were examined. Both factors have significant influence on the model predictions. It is evident that the reaction kinetics and the distributor plate must be subjects of experimental studies to supply the information needed for refining the model.

JPL reported progress in the in-house program for the study of the silane fluidized-bed system. A seed-particle cleaning procedure was developed to obtain material purity near the level required to produce a semiconductor-grade product. The liner-seal design has been consistently proven to withstand heating-cooling cycles in all of the JPL experimental runs. A summary of the JPL silane fluidized-bed program is being written.

The California Institute of Technology (Caltech) presented a more complete analysis of the phenomenon of runaway nucleation in a silane-free space reactor system which occurred in its program to describe, theoretically, the growth of silicon particles and to develop, experimentally, the conditions for particle growth. The experimental conditions with a silane concentration increment leading to the condition and the theoretical treatment of the phenomenon were described.

JPL presented a thermal analysis model to describe the dendritic ribbon process. The model uses a melt-dendrite interface which projects out of the bulk melt as the basic interpretation of the ribbon production process. This is a marked departure from the interpretations of the interface phenomena which have been used previously. The model was extensively illustrated with diagrams and pictures of ribbon samples. This model would have great impact on the analyses of experimental data as well as on future design modifications of ribbon-pulling equipment.

JPL also presented simplified models of the residual stress in dendritic ribbons and of the associated ribbon properties.