Possible Responsibility of Silicone Materials for Degradation of the CO$_2$ Removal System in the International Space Station

Mario Baeza, Hemant Sharma, David Borrok, Mingua Ren, Keith Pannell

From data concerning the degradation of the CO$_2$ removal system in the International Space Station (ISS) two important features were apparent:

1. The atmosphere within the International Space Station (ISS) contained many organic compounds including alcohols, halocarbons, aldehydes, esters, and ketones, *inter alia*. Various cyclosiloxanes D$_n$, hexamethylcyclotrisiloxane (D$_3$) and its higher homologs (D$_4$) and (D$_5$) are also present presumably due to offgassing.

2. Screens within the zeolite-containing canisters, used for the removal of CO$_2$, exhibited partial clogging due to zeolitic fragments (dust) along with “sticky” residues, that *in toto* significantly reduced the efficiency of the CO$_2$ removal process.

Samples of the ISS fresh zeolite, used zeolite, filter clogging zeolite particles and residual polymeric materials were examined using, *inter alia*, NMR, EM and HRSEM. These data were compared to equivalent samples obtained prior and subsequent to D$_n$ polymerization experiments performed in our laboratories using the clean ISS zeolite samples as catalyst. Polysiloxane materials produced were essentially equivalent in the two cases and the EM images demonstrate a remarkable similarity between the ISS filter zeolite samples and the post-polymerization zeolite material from our experiments. In this regard even the changes in the Al/Si ratio from the virgin zeolite material to the filter samples and the post-polymerization laboratory samples samples is noteworthy.

This research was supported by a contract from the Boeing Company.