Title: Investigation of Post-Flight Solid Rocket Booster Thermal Protection System

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Abstract:

After every Shuttle mission, the Solid Rocket Boosters (SRBs) are recovered and observed for missing material. Most of the SRB is covered with a cork-based thermal protection material (MCC-1). After the most recent shuttle mission, STS-114, the forward section of the booster appeared to have been impacted during flight. The darkened fracture surfaces indicated that this might have occurred early in flight. The scope of the analysis included microscopic observations to assess the degree of heat effects and locate evidence of the impact source as well as chemical analysis of the fracture surfaces and recovered foreign material using Fourier Transform Infrared Spectroscopy and Scanning Electron Microscopy/Energy Dispersive Spectroscopy.

The amount of heat effects and presence of soot products on the fracture surface indicated that the material was impacted prior to SRB re-entry into the atmosphere. Fragments of graphite fibers found on these fracture surfaces were traced to slag inside the Solid Rocket Motor (SRM) that forms during flight as the propellant is spent and is ejected throughout the descent of the SRB after separation. The direction of the impact mark matches with the likely trajectory of SRBs tumbling prior to re-entry.