SILICA TILES AS A THERMAL PROTECTION FOR RLV-TD

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Abstract

An important challenge during a re-entry flight is to manage the heat dissipation of the vehicle as it slows from orbital velocity to touchdown speeds. The orbiting vehicle has to be protected from the high heat load by suitable Thermal Protection Systems (TPS) to prevent the structure from burning and disintegration. Methods that are commonly used in TPS design are, radiation back to space, conduction using a heat sink, ablation, and active cooling. Radiation is the most important approach because heat rejection is a function of absolute temperature to the forth power. The silica tiles employed in space shuttle, Space Capsule Recovery Experiment (SRE) and in the Reusable Launch Vehicle Test Demonstrator (RLV-TD) works on this principle. The silica tiles used in RLV-TD consists of high purity silica fibers that act as a reinforcement. The binding matrix is silica obtained through a sol-gel process.The silica billets are sintered at 1275°C and machined to the required contours. These tiles are subsequently given a high emissivity coating on the exterior. Some unique properties of these tiles are its low density (< 0.35g/cc), low coefficient of thermal expansion (0.5×10^{-6}/°C), low thermal conductivity (< 0.05 W/mK) and high emissivity (> 0.85). Besides they are RF transparent. These tiles are designed to withstand a skin temperature of 1400°C during its re-entry flight.

Keywords : Silica Tiles, Thermal Protection System, Emissivity