Plasmatron Testing of Hybrid-TPS

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During the previous 2 years a new "HybridTPS" thermal protection system is under development at the NCSR "Demokritos" in Greece. The system exploits the synergy between a rigid, high refractoriness porous ceramic and a contained reinforced ablator as a heat-sink and is aimed at thermomechanical protection for high velocity atmospheric entries. The Hybrid-TPS project is funded by the European Space Agency and is expected to address some of the known problems with currently used ablative TPS, such as irregular recession of front surface leading to localised turbulence, disturbed shock wave, displaced centre of gravity and extremely brittle post-ablation char.

The Hybrid-TPS has been characterised and tested under plasma-jet conditions in the Plasmatron at the Von Karman Institute in Brussels up to 2.5MW/m2 peak heat flux and for a maximum of 215 MJ/m2 integrated heat load. The areal density of the tested materials varied from 23 to 33kg/m2 and all specimens had a total thickness of about 25mm. The results are promising. Front surface recession was nearly zero while plasma-induced surface roughness was very low and depended mainly on initial surface conditions.

The Hybrid-TPS system is produced as tiles of various shapes and sizes, curved as well as flat, and may be side-bonded to each other in such a way as to minimize the effect of interfaces on a probe shield.

New development are aimed at adding a thin front-surface coating and at higher heat flux and integrated heat load capability. A 25cm diameter heat shield model will be constructed and plasma-jet tested during 2008.