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ABLATIVE MATERIAL BASED ON EPOXY RESIN FILLED WITH HOLLOW GLASS AND PHENOLIC RESIN MICROSPHERES

Abstract

The renewed interest in space exploration and interplanetary missions has brought to forefront the problems associated with reentry in the atmosphere of "blunt body" shaped spacecraft equipped with ablative thermal protection systems (TPS). This kind of TPS is necessary due to the high speed experienced during the reentry phase, with the associated high value of the heat flux, that doesn't suggest the adoption of thermal insulating materials like the ones employed in reusable vehicles. Up to now a matrix based on phenolic resin is used thanks to the highest operative temperature compared with the epoxy resin (up to 400C); furthermore phenolic resin shows a rate of carbonization higher than that of epoxy, due to a large presence of benzene rings. On the other hand, however, a phenolic resin matrix has weak structural properties. In the present paper an alternative design solution will be explored based on an epoxy resin matrix filled with hollow glass or phenolic resin microspheres. A comparison of thermo-mechanical properties for different kind of mixing ratios will be performed. The innovation of present work consists of the use of a modified polymeric catalyst which allow to increase the pyrolysis yield and to improve the mechanical properties, if compared with a commercial product. The results obtained with two commercial epoxy resins, both cured with the modified curing agent, will be compared with these from the same resins when hardened with a commercial product. The effects of the addition of the inert fillers will be also evaluated.

Index Terms — Ablative Materials, TPS, Pyrolysis, Hollow glass, Phenolic microspheres