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Author: Ms. Luo Lijuan
China

A NEW MULTI-LAYER AND GRADED-DENSITY FLEXIBLE ABLATOR

Abstract

In order to meet the requirement of weight saving and excellent thermal protective performance of flexible thermal protection system, a new multi-layer and graded-density flexible ablator (MGFA) was devised and prepared. Each layer with a thickness of 0.6mm consisted of a thin aluminium-coated polyimide (ACPI) film and a silicon rubber matrix reinforced by glass fibre. Density of the new MGFA was graded by layer and the density of each layer decreased with the increasing layers from the outside layer. MGFA was evaluated by oxyacetylene ablation test with heat flux density of 340 kW/m2•s and 430 kW/m2•s in 65 seconds, respectively. Different from conventional MGFA, aluminium-coated polyimide film in the new MGFA could efficiently radiate or reflect parts of the influx heat. Therefore, comparing with conventional MGFA without ACPI film, new MGFA with an ACPI film had a better thermal protective effect, in which fewer layers were burned out and the back-face temperature was lower than that of conventional MGFA. At the same time, a lot of micro-pores were introduced into the silicon rubber matrix, which apparently reduced the weight, thermal conductivity and the back-face temperature of graded-density flexible ablator compared with uniform density flexible ablator. In summary, the new composite with the aluminium-coated polyimide layer, graded-density and porous silicon rubber matrix gave the new composites outstanding ablation performance. It could be a promising material in application on the deployable aeroshell flexible thermal protection system.