

MATERIALS USED IN SPACE RE-ENTRY VEHICLES

“An insight into the use of nanotechnology in vehicle design”

Venkata Siva Anil Kumar Maddala, T Vijayaraghavan, S Arul Selvan

VIT University, Vellore

Objective:

To design space re-entry vehicles using self healing materials by in cooperating Nanomachines to rectify surface cracks caused due to extreme heat and cold, aging process, etc.

Need:

One of the major hurdles faced in space exploration is that the space vehicles may not re-enter the earth's atmosphere safely (using the existing technologies and materials). This has led to certain events like Columbia space shuttle mishap in 2003, which led to the loss of seven promising NASA astronauts and valuable equipment. The tragedy led to increased focus on the materials used in the design of space vehicles. Our study is based on the use of nanotechnology to enhance the safety, durability and cost effectiveness of such materials used.

Proposal:

Damage to a spaceship's hull often begins as tiny surface cracks, which are invisible to the eye. Once these cracks form, they will grow until the material weakens and breaks. In order to prevent these tiny cracks from spreading, a new material has been developed that will sense damage and mend itself instantly. This self-healing ability could significantly prolong the life of the spacecraft. There are three parts to this new self-healing material. One of them is the **Composite material** which is basically an epoxy polymer composite. The second part is a **Microencapsulated healing agent** which is the glue that fixes the micro cracks formed in the composite material. Finally, the healing agent must come into contact with a catalyst. A patented catalyst, called **Grubbs' catalyst**, is used for this self-healing material.

Nanotechnology can be used to fulfil the above purpose by using nanomachines that can be released to repair a crack formed in a spacecraft's composite shell by sucking in surrounding molecules (the healing agent and the catalyst).