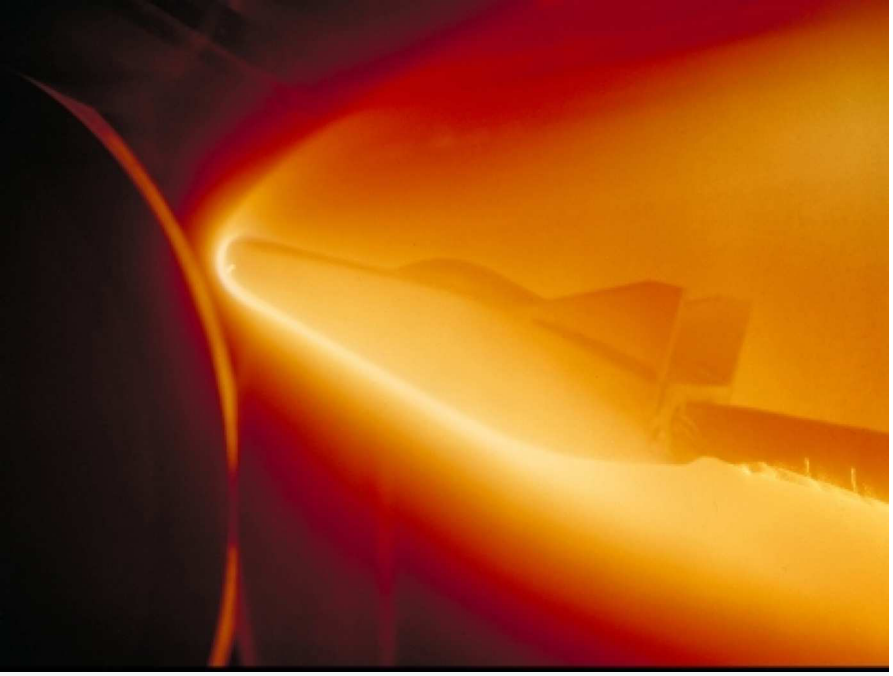

National Aeronautics and Space Administration

Aeronautics

Heat Shield

Heat Shield Employing Cured Thermal Protection Material Blocks Bonded in a Large-Cell

Researchers at NASA Ames Research Center have found a new way to integrate thermal protection materials on external surfaces of vehicles that experience the severe heating environments of atmospheric entry from space. Cured blocks of thermal protection materials are bonded into a compatible, large-cell honeycomb matrix that can be applied on the external surfaces of the vehicles. The honeycomb matrix cell size, and corresponding thermal protection material block size, is envisioned to be between 1 and 4 in. (approx. 2.5 and 10 cm) on a side, with a depth required to protect the vehicle. The cell wall thickness is thin, between 0.01 and 0.10 in. (approx. 0.025 and 0.25 cm). A key feature is that the honeycomb matrix is attached to the vehicles unprotected external surface prior to insertion of the thermal protection material blocks. The attachment integrity of the honeycomb can then be confirmed over the full range of temperature and loads that the vehicle will experience.

BENEFITS

- Robust and testable in ground-based facilities
- Withstands the anticipated surface temperatures
- Adapted to correspond to different entrant configurations of the vehicle
- Uniform-sized thermal protection material blocks
- Allows for mass production of thermal protection material blocks - convenient for quality control
- Provides a pre-attached honeycomb matrix to support the thermal protection materials

technology solution

THE TECHNOLOGY

Another key feature of the innovation is the use of uniform-sized thermal protection material blocks. This feature allows for the mass production of these blocks at a size that is convenient for quality control inspection. The honeycomb that receives the blocks must have cells with a compatible set of internal dimensions. The innovation involves the use of a faceted subsurface under the honeycomb. This provides a predictable surface with perpendicular cell walls for the majority of the blocks. Some cells will have positive tapers to accommodate mitered joints between honeycomb panels on each facet of the subsurface. These tapered cells have dimensions that may fall within the boundaries of the uniform-sized blocks.

Atmospheric entry from space

APPLICATIONS

The technology has several potential applications:

- Re-entry vehicles
- Space missions
- Aerospace industry

PUBLICATIONS

Patent No: 7,662,459

More Information

National Aeronautics and Space Administration

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NP-2015-02-1417-HQ

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ARC-16018-1