



## Technology DRDO 219: Ceramic Composites Integral Armour

The present innovation is a unique technology to produce lightweight, maintenance-free and easily repairable multifunctional engineered material known as Ceramic Composite Integral Armour which can be used for structural requirements and ballistic threats. The innovation is lighter and more efficient than metals and it can be integrated with the composites to provide alternative solutions to the current bulky metallic structures with add-on/strap-on armour.

The armour combines the structure with ballistic protection and is fabricated by Vacuum Assisted Resisted Resin Transfer Moulding (VARTM) process. Ceramic-composite integral armour has ceramic layer, rubber layer, backing composites structural layer, cover layer and other functional layers such as layers for fire-protection. The ceramic layer provides primary ballistic protection while the composites layer is the structural layer.

Integral armour is lighter as it exploits the benefits of ceramics more than strap-on armour because of the additional confinement of ceramics achieved due to integration of structure and armour. Its modular construction using small ceramic tiles allows for its easy repair after impact and easy compliance with complex shapes. There is no need of spall-liner leading to additional weight reduction.

This technology is a method to provide ballistic protection along with structural functionality to a vehicular component. Entire vehicle structure along with the armour protection is realized in firing, eliminating joints and parasitic mass by VARTM process. This methodology can be directly applied to smaller military fighting vehicles such as armoured personnel carriers with protection against 14.5mm AP shot and for armourising commercial vehicles belonging to paramilitary forces against 7.62 AP (AK-47) shot at substantially lower weights than a conventional armour. Ceramics composites integral armour has been extensively tested for ballistic protection against 7.62AP and 14.5AP shots successfully.

The present technology can be used for ballistic protection for VIP vehicles, low intensity conflict vehicles, urban warfare systems, ballistic protection for unmanned vehicles, missile transport vehicles, armoured vehicles, underwater structures, assault boats, other naval structures, aircrafts, helicopters and any other structures subjected to ballistic threats. This technology offers a significantly lightweight, maintenance-free and easily repairable composite-ceramic integral armour based alternative to the currently heavy and bulky metallic structures with add-on/strap-on armour.

### Development Status

- Technology is fully developed.

### IP Status

- An Indian patent is pending.

### Partner Opportunities

- Manufacturing licensing agreements.
- Sales through distribution channels.

For additional information contact Earle Hager, IC<sup>2</sup> Institute Global Commercialization Group at 512-475-7789, 512-431-3940 or [ehager@ic2.utexas.edu](mailto:ehager@ic2.utexas.edu).

