

Composites are the Future in Military Vehicles

“I just want to leave you with this message: ‘The future is composites.’” The speaker is Dr. Jack Gillespie, director of the Center for Composite Materials and professor in the College of Engineering at the University of Delaware. The remark was made during a symposium at the 2009 Association of the U.S. Army exposition. OCV™ Reinforcements hosted the event to report its return to S-glass production with breakthrough technology that enables large-scale manufacturing for wider availability.

The symposium featured three speakers, including Gillespie, who discussed the future of composites in defense applications. The others were Matthew Diehl, engineering manager for advanced programs in the Armament and Technical Products division of General Dynamics, and Dave Hartman, senior research associate at Owens Corning. They agreed that the future of composite materials for military vehicles is in lightweight integrated structural armor.

Gillespie identified four performance characteristics that are attractive for defense applications – performance-to-weight ratio, potential for multi-functionality, reduction of parts count and ability to withstand severe service conditions. “These are classic benefits of composites,” he said.

“Fuel accounts for 70 percent of the bulk tonnage required by a heavy military division, making reduced weight and increased fuel efficiency a priority for command leaders and vehicle manufacturers,” continued Gillespie. “Speed, range and signature management (minimizing detection by electronic systems) are all improved by composites use.”

“*In the future, we’ll see applications that combine several functions in an integrated component,*”

continued Gillespie. “If you really take advantage of composites in design, you can eliminate parts, reduce costs and greatly improve the overall performance of the system,” he explained.

Gillespie also said new applications need to be both possible and affordable. “If you can deliver performance but (the customer) can’t afford it, it’s the same as not delivering the performance,” he explained.

Diehl said toughness is a big consideration for military vehicle manufacturers.

“Materials have to be capable of off-road use,” he explained. “In the military vehicle world that means rocks are banging into them, they are climbing over structures, crashing through trees and occasionally knocking down walls.

“The material also has to survive many years in the field, in hot sun and rain and humidity and snow and freezing, and back to hot again,” he continued.

“The solution we’re coming to is largely in the fiberglass realm,” said Diehl. “Epoxy resins have some advantages and we’re fond of VARTM fabrication (vacuum assisted resin transfer molding), because VARTM tends to fill up the inside of the fabric. There is some weight associated with that but it means the fabric won’t fill up with diesel fuel, water and other things that could damage armor from the inside.”





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Diehl also asked the rhetorical question:

“Is all S-glass the same?”

“We’ve done a fair amount of testing and the answer to that question is, ‘No, it’s not really all the same,’” said Diehl. “To bear the S-glass name it has to be in the same general realm of properties, but with military structures, plus or minus 10 percent, or plus or minus 20 percent, really isn’t good enough. You really have to understand how what you are building is going to perform in the field, so there is a fair amount of testing that goes into it. That’s for our own education, but also so we can show our customer its going to do what we intend it to do.

“We did some punch testing with laminates we built up with ShieldStrand® S reinforcements, working with a number of different resins, and came up with data for maximum load and total energy absorption. The ShieldStrand® S

reinforcement showed us some moderate gain in max load and energy absorbed.

“ShieldStrand® S reinforcements have performed nicely for us, certainly in shear testing that’s been done,” continued Diehl. “The product is delivering what we had hoped for – equal or likely better results in punch testing. We’ve been working with it in body armor and look forward to it in vehicle form.”

Hartman said lightweight vehicles with durable protection are enabled with ShieldStrand® S reinforcements. He pointed out that the reinforcements are produced in a large-scale manufacturing process that makes them more affordable. And because of the scale, the material is readily available.

“One of the key things we have been working to overcome in composites is the perceived risk in using high-strength reinforcement materials due to concerns about availability,” said Hartman. “We have had some success but there is much more opportunity.

Hartman said large-scale production provides a supply chain that is less volatile and can support the surges that are common in defense applications. “With direct-melt S-glass, we can be all about reducing risk and making that perception a concern of the past.”

For more about high-performance reinforcements from OCV™ Reinforcements, visit <http://www.ocvreinforcements.com/urlmaker/hp.asp>



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