Mechanical Technology

Composite Tank Technologies

With improved structural integrity

Innovators at NASA's Marshall Space Flight Center have developed several new designs and methods of fabrication for composite and composite-over-wrapped tank vessels that help significantly improve their structural integrity against impact, abrasion, harsh environments, and fire. Several embodiments of this technology portfolio also enable production of composite tanks capable of transporting liquefied natural gas or other cryogenic liquids. These innovations are applicable to important aerospace needs, including propulsion systems as well as new and growing fields such as natural gas transportation.

Benefits

- **Strong**: Enables improved structural integrity for vessels that can withstand impact, fire, and other harsh conditions
- **Versatile**: Suitable for containing a wide range of materials—from high-pressure gases to liquid cryogens—over a wide range of temperatures
- **Lightweight**: Provides improvements that allow vessels to be lighter than previously available tanks of comparable strength
- **Scalable**: Offers designs and methods that can be easily tailored to large structures and easily handle tooling and materials changes

technology opportunity

Commercial Applications

- Pressure-fed propulsion systems
- Natural gas and other fuel transportation
- Self-contained breathing apparatus (SCBA) tanks for emergency responders
- Storage tanks for fuels, gases, and cryogenic fluids

The Technology

What it is

NASA researchers have achieved and demonstrated technologies that increase the performance and robustness of composite tanks and pressure vessels. Their innovations have been applied to lined (metallic and non-metallic) composite over-wrapped pressure vessels and to all-composite tanks and pressure vessels. The methods involve a unique combination of fibers and resin systems that result in superior resistance to impact damage and extreme environments while remaining lightweight and cost effective.

Further enhancements are ideal for the containment of compressed natural gas and liquefied natural gas. For example, custom-tuned materials applied to the vessels enhance the ability to contain cryogenic fluids and perform well under extreme environments. The addition of insulation and protective coatings augment the long-term storage of cryogenic fluids. The composite tank technologies have demonstrated superior performance in U.S. Department of Transportation (DOT) bonfire and ballistics tests.

Why it is better

Many currently available composite vessels are easy to damage by impact and do not perform well in high-temperature or cryogenic environments. Auto industry standards for natural gas and hydrogen containment are strict, and most current tank technologies have difficulty meeting them. In contrast, the use of NASA's technologies allows them to surpass the minimum industry standard requirements. For example, composite vessels pressurized with liquid nitrogen and impacted with a 50-caliber, armor-piercing bullet withstood fragmentation in tests. Other vessels using NASA's technologies demonstrated the same burst pressure as a non-fire-exposed vessel after undergoing an entire bonfire test.

Patents

NASA's Marshall Space Flight Center has received patent protection for these technologies (U.S. patent Nos. 6,158,605; 6,193,917; and 6,953,129), and is seeking additional patents.

Licensing & Partnering Opportunities

These technologies are part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about the licensing possibilities for its composite tank technologies (MFS-31379-1, MFS-31379-2-DIV, MFS-31727-1, MFS-31838-1, MFS-32024-1, and MFS-32390-1) for commercial applications.

For More Information

If you would like more information about these technologies, please contact:

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