

## Production Gains Make Versatile Material Affordable

*Hybrid Plastics Reduces Cost and Time of Producing Nanostructured Chemicals*



Scientists test polyhedral oligomeric silsesquioxanes (POSS) at International Space Station.

**The Challenge**—In the 1960s General Electric researched a class of chemicals called polyhedral oligomeric silsesquioxanes (POSS) nanostructured chemicals, which the U.S. Air Force developed in the early 1990s. A hybrid of organic and inorganic molecules, POSS had unique characteristics that were enhanced further by its size (one-billionth of a meter). When formed into polymers, POSS is lightweight, odorless, fire and heat resistant, disposable, and rust-resistant.

However, producing just one pound of POSS cost up to \$5,000 and took three months. If these costs could be reduced and the process streamlined, POSS could be widely used to the benefit of the plastics industry and the U.S. economy. Hybrid Plastics, a small company that had spun off from the Air Force Research Laboratory, wanted to explore cheaper feedstock and new processes. Because of the high technical risk and innovation required, the company applied for and won an ATP award.

**The Outcome**—With ATP funding Hybrid Plastics discovered ways to produce POSS from cheaper materials, reducing production costs to \$10-50 per pound and cutting processing time to one day. Hybrid's POSS Polymer System is unprecedented in the nanostructured materials field. The company

developed a product line of 158 types of materials, all based on the same molecular structure but using different raw materials. Hybrid holds 10 patents on this research.

Hybrid Plastics also built a unique process by which it could vary the organic component of the POSS molecule to build several compounds, including those having the ability to bond chemically with other substances. In 2006, the company incorporated metal atoms at the vertices of the POSS molecule to create a new nanostructured material called polyhedral oligomeric metaloquioxanes (POMS).

The company has lived up to market analysts' expectations by offering a diverse range of POSS nanostructured products based on the ATP-funded technology. Hybrid Plastics has commercialized the POSS technology for use in a wide range of applications from dental products to meat packaging to space shuttles.

In 2005 the Federal Government recognized POSS technology as having "strategic national interest." This has significantly boosted the technology's importance, as well as the company's potential to commercialize it. Hybrid Plastics expects to raise its annual production level of 20,000 pounds of POSS in 2005 to 2 million pounds in 2009.

<b>Partnering Organization:</b>	Hybrid Plastics, Hattiesburg, MS
<b>Project Duration:</b>	10/1/1998 – 9/1/2001
<b>Project Cost:</b>	\$1.9M ATP cost-share; \$0.2M industry cost-share
<b>Project Brief:</b>	<a href="http://jazz.nist.gov/atpcf/prjbriefs/prjbrief.cfm?ProjectNumber=98-01-0059">http://jazz.nist.gov/atpcf/prjbriefs/prjbrief.cfm?ProjectNumber=98-01-0059</a>
<b>Project Status Report:</b>	<a href="http://statusreports.atp.nist.gov/reports/98-01-0059.htm">http://statusreports.atp.nist.gov/reports/98-01-0059.htm</a> Research conducted March 2006