NASA researchers replace silica with polymers to create more flexible aerogels

September 28 2012, by Bob Yirka

Credit: NASA's Glenn Research Center

(Phys.org)—Back in the early thirties, the story goes, a couple of unknown chemists set about betting one another as to whether they could remove the water from a jelly that had been gelled with pectin, without causing the jelly to shrink. The resultant efforts produced what are

known today as aerogels, sometimes referred to as liquid smoke because of their very low densities. Chemists have produced them by mixing silica based materials with water, then removing the water via supercritical drying. Unfortunately, the material produced is very brittle and thus easily broken which limits its use. Because of this researchers at NASA's Glenn Research Center looked to polymers (types of plastics) to see if a new type of aerogel could be created that would be less brittle.

In the research, led by Mary Ann B. Meador, who described the teams' efforts at a recent national meeting of the American Chemical Society, the group first tried coating the silica with various polymers to see if they could reduce the brittleness, but such efforts proved very slow and the results exhibited low melting temperatures, which reduced their usefulness. For those reasons, they wondered if it might not be possible to simply replace the silica with some type of polymer altogether, because the only purpose of the silica in the first place was to allow for a structure to exist. The problem of course, is that with most such polymers, when subjected to supercritical drying, they tend to shrink, just like jellies back in the thirties. Thus, the team had to find another approach.

That approach involved cross linking certain polymers with a bridging compound resulting in a new polymer that was stiff enough to hold its shape when subjected to supercritical drying, yet would remain flexible overall; an approach that worked so well that the team was able to create several different types of polymer aerogels that exhibit extraordinary properties.

Some of the new examples proved to be exceedingly strong; enough so to support a car when constructed as a thick slab and placed under a tire, the team reports. Others could be made into thin sheets with superb thermal resistance due to their being up to 95% air, which opens the door to a myriad of possibilities ranging from sleeping bag linings to new

kinds of refrigerator insulation.

More importantly perhaps, at least to the research team, this being NASA after all, are the possibilities the new aerogels allow for future space missions, from space suit insulators to decelerator vehicle components that could one day help craft make it safely through the oftentimes harsh atmospheres found on other planets.

More information:
Polyimide Aerogels
Polymer Aerogels Provide Insulation For Earth And Space