ABSTRACT

The field of Nanotechnology is well funded worldwide and innovations applicable to Solar System Exploration are emerging much more rapidly than thought possible just a few years ago. This presentation will survey recent innovations from nanotechnology with a focus on novel applications to atmospheric entry science and probe technology, in a fashion similar to that presented by Arnold and Venkatapathy [1] at the previous workshop forum at Lisbon Portugal, October 6-9, 2003.

Nanotechnology is a rapidly emerging field that builds systems, devices and materials from the bottom up – atom by atom – and in so doing provides them with novel and remarkable macro-scale performance. This technology has the potential to revolutionize space exploration by reducing mass and simultaneously increasing capability.

Thermal, Radiation, Impact Protective Shields: Atmospheric probes and humans on long duration deep space missions involved in Solar System Exploration must safely endure 3 significant hazards: (i) atmospheric entry; (ii) radiation; and (iii) micrometeorite or debris impact. Nanostructured materials could be developed to address all three hazards with a single protective shield, which would involve much less mass than a traditional approach. The concept can be ready in time for incorporation into NASA’s Crew Exploration Vehicle, and possible entry probes to fly on the Jupiter Icy Moons Orbiter (JIMO) mission.

Orbiter (JIMO) mission.

Nanochemistry: New composite materials that may enhance pressure vessels for atmospheric probes of the gas giants: Studies underway suggest that Titanium/Fullerene composites may improve the capability of pressure vessels for probes like that used for the Galileo Probe mission to Jupiter.

Putting it all together: It appears that nanotechnology may be a key to enabling nanoprobes (1 < 10 kg), helping realize planetary atmospheric scientists’ desire for “multiple probes to multiple worlds”1.
REFERENCE