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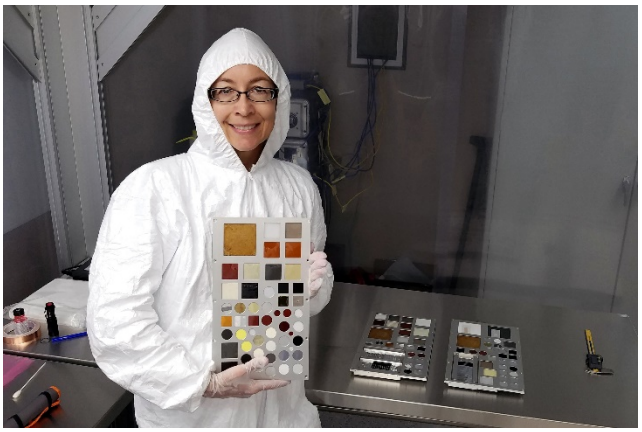
April 2, 2018- Tor Vergata on Orbit with a new Experiment on Shape Memory Composites and Cosmic ray Shielding Materials.

Professors Loredana Santo and Fabrizio Quadrini of the Department of Industrial Engineering put 3 samples (2 Shape memory composites – SMCs and 1 Cosmic ray shield – CRS) in MISSE-9 Polymers and Composites Experiment (PCE). The experiment, the third on orbit for the research group, has been developed in collaboration with NASA's Glenn Research Center in Cleveland. The principal investigator (PI) is Kim de Groh, a senior materials research engineer (in the picture below during the experiment implementation on Earth). This collaboration between Tor Vergata University and NASA's Glenn Research Center has been called M.inO.S. (Materials in Open Space) and remembers the mythological king of Crete, at the beginning of our civilization. A new civilization is now necessary for the Space, and common efforts are necessary to solve countless technological and material challenges.

MISSE-9 along with ISS's new external MISSE-Flight Facility (MISSE-FF) (http://www.alphaspace.com/) was launched as part of the SpaceX Commercial Resupply Service-14 (CRS-14) mission to the International Space Station (ISS) on Monday April 2, 2018 at 4:30 pm EDT (20:30:38 GMT). The Dragon spacecraft (https://twitter.com/esaspaceflight/status/978611916779216897) was launched on a Falcon 9 rocket from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida.

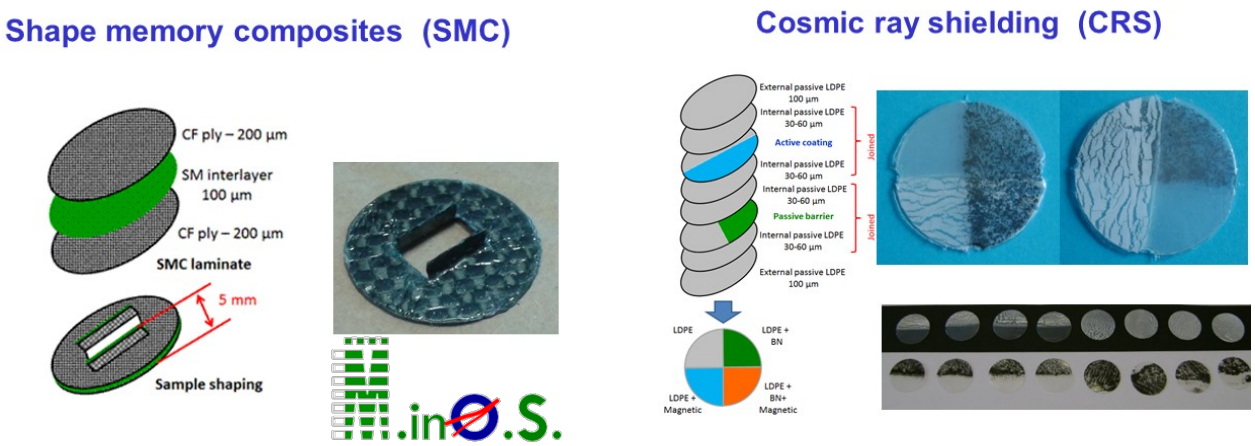
138 different material samples were sent to the International Space Station (3 of them by University of Tor Vergata). De Groh and her international collaborators want to know how long these materials (polymers, composites and coatings) will last in outer space due to the exposure to atomic oxygen and sun radiation. Flight data are needed to predict material performance and durability for future spacecrafts and structures.

MISSE-9 will expose materials in each flight orientation on the space station. This includes forward facing known as "ram," rear-facing known as "wake," space-facing known as "zenith," and Earth-facing, known as "nadir." Flying samples in each orientation will show how the varying atomic oxygen and solar exposures in each position affect material. More details in https://www.nasa.gov/feature/predicting-the-lifespan-of-materials-in-space.



The PI in the cleanroom at Alpha Space in Houston holding the MISSE-9 ram experiment tray; the wake (left) and zenith (right) trays are on the bench (Credit NASA).

The experiments of the Tor Vergata team will evaluate the behavior of shape memory composites and cosmic ray shielding materials in the space environment.




Sample conceptual design and production

The sample SMC is made by two composite plies and one shape memory interlayer. The experiment will show if sample recovery could happen in orbit, because of direct heating from the sun or heat transfer from the surrounding platform. In addition, it will be possible to estimate the aging effect of the Space exposure in terms of mass loss, material degradation (cross-linking, chain polymer break, delamination, and embrittlement) and, above all, loss of performances (including shape memory behaviour). The sample CRS is a combination of Low-density polyethylene LDPE sheets and inorganic substances (samarium cobalt and boron nitride powders). That is a first step toward the definition of new shielding materials mainly for Space suites (i.e. flexible) but possibly also for spacecrafts.

New materials, new systems are necessary not only for Space colonization. Being a harsh environment, materials tested in the Outer Space may have a lot of uses on the Earth. The Space has been always and continues to be the mean for human development. In the past we navigated with stars, in the future we will navigate toward them.