



***Ph.D. School in Chemical Sciences
Cycle XXXVIII***

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Research project title: Astropolymers: Innovative Materials Towards Robotic and Human Exploration of Extraterrestrial Habitats

Key words: Superhydrophobic polymers, technopolymers, dust mitigation, thermal resistance, cosmic radiation resistance

Research project abstract: Dust in space environments, especially Moon and Mars has been recognized by several Space Agencies, including NASA and ESA, as a major concern for the successful robotic and human exploration and colonization of extra-terrestrial bodies. Lunar surface is covered by regolith, a granular material that mainly consists in silicate and non-silicate minerals, crushed by meteoric impacts and scattered in the form of micrometric, sharp and abrasive, dust particles. This particulate is electrostatically charged by the local plasma and the solar radiation and can adhere strongly to exposed surfaces of all materials used in the space missions, such as mechanical and electronic devices, sensors, solar cells and astronauts' suits, causing serious problems to devices and astronauts. Aim of the present project is the design and the synthesis of innovative, lightweight polymeric materials with elevated strength-to-weight ratio able to mitigate dust deposition. Aromatic poly(imides) and copoly(imides) having molecular structures suitably designed to achieve the desired properties of high glass transition temperature, superhydrophobicity, low surface energy, low adhesion and self-healing will be synthesized. The surface properties of these materials will be characterized and modified by, for example, incorporation of special low molecular weight additives able to spontaneously migrate toward the surface reducing the surface energy or through the application of techniques of surface patterning. The material will be finally tested for the dust mitigation application.