

Polymer Aerogels for Lunar Applications and Beyond

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As the space community endeavors to reach new heights of human exploration in the coming decade, materials for extreme environments are at the forefront of materials research at NASA. One class of materials of particular focus is polymer aerogels; lightweight solids with nanoscale pore sizes, high internal surface area, low thermal conductivity, extremely high porosities, and high mass-normalized strength and stiffness properties. Thanks to these interesting properties, polymer aerogels are ideal as dust-free multifunctional thermal insulators but are by no means limited to this application. The high porosity and surface area also make polymer aerogels an ideal host system for particle incorporation for applications such as catalyst supports, sensor platforms, and vibroacoustic mitigating materials. Polymer aerogels also have the potential to combat issues found in extraterrestrial environments such as dust and radiation mitigation. Emerging commercial applications including 5G antennas, multifunctional engineering plastics, and bulletproof vests are also making use of these materials. Herein, current research and applications related to NASA's polymer aerogels in support of space exploration in the next decade will be presented.