

CLPS 2022

COMMERCIAL LUNAR PAYLOAD SERVICES

SURVIVE THE NIGHT Technology Workshop

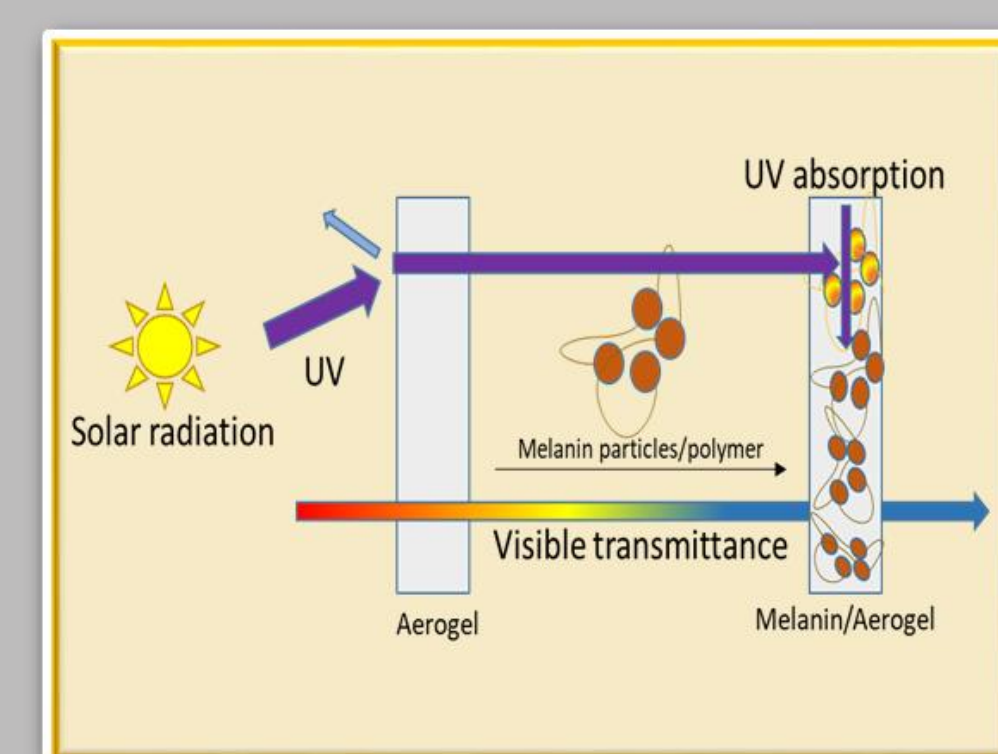
December 6–8, 2022

NASA Glenn Research Center • Cleveland, Ohio

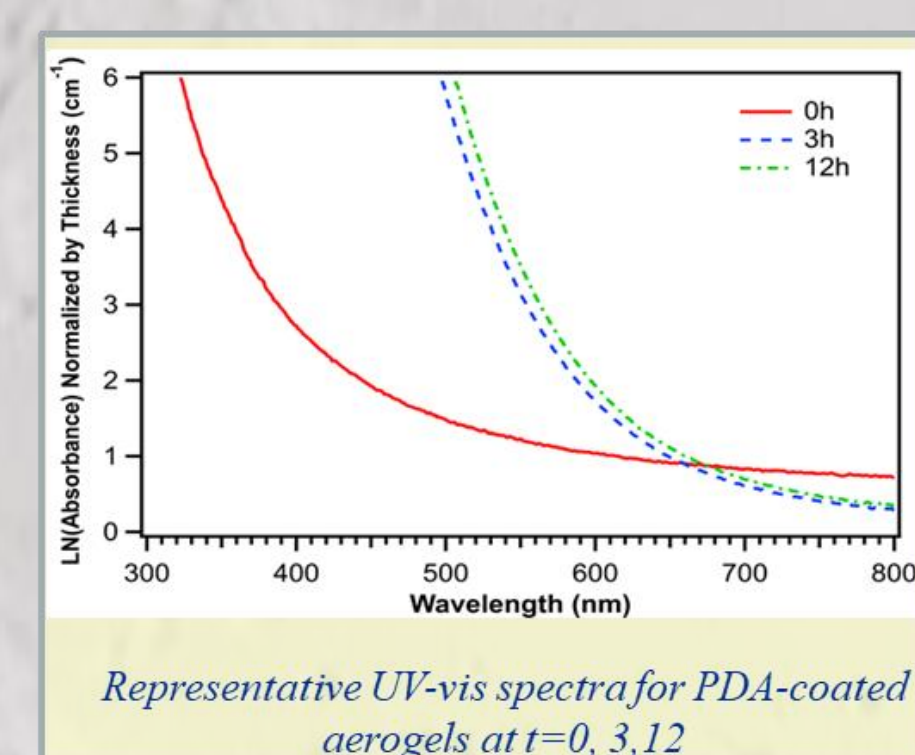


Polymer Aerogels for Lunar Survivability (PALS) – Stephanie Vivod (GRC), Matt Deminico (GRC)

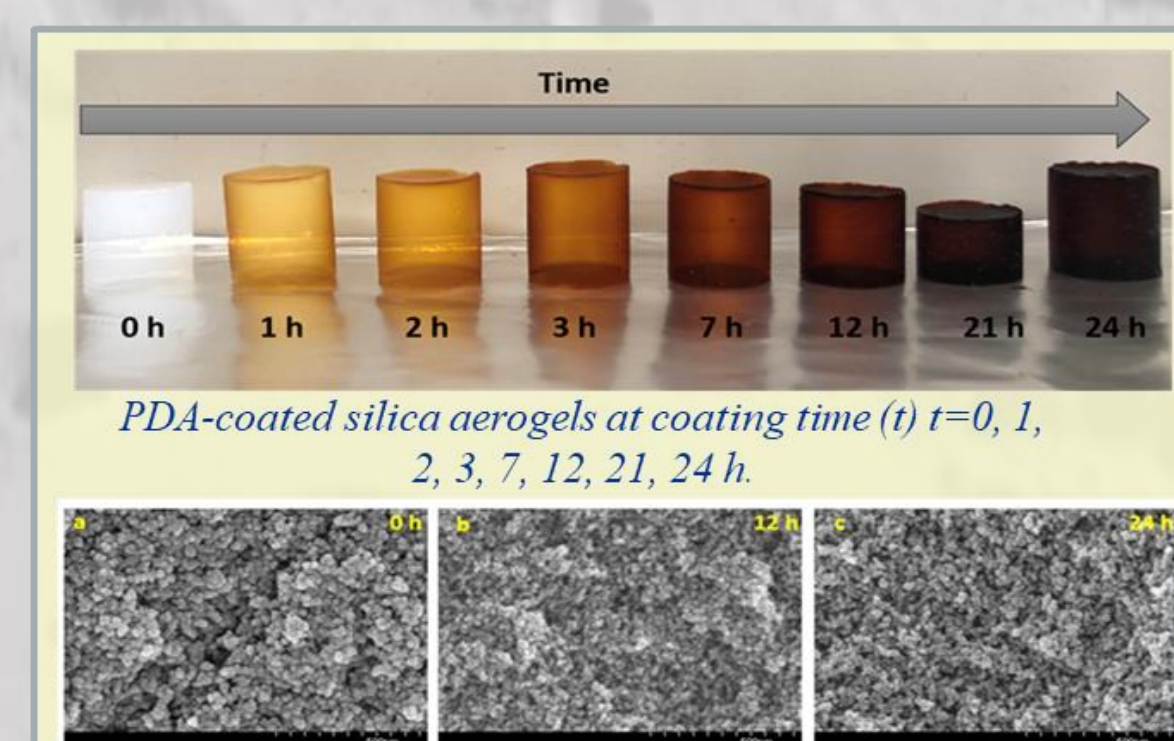
As the Space Community endeavors to reach new heights of exploration, materials for extreme environment are on the forefront of research. One such material would include polymer aerogels; lightweight solids with nano-scale pore size (10-20 nm), high internal surface area (500-850 m²/g), low thermal conductivity (~20 mW/K), low density (0.15-0.05 g/cm³) and extremely high porosities (>95%). Due to these interesting properties, aerogels are ideal as thermal insulators and are by no means limited to this application. The high porosity combined with high surface area, make aerogels an ideal host system for particle incorporation for applications such as IR filtration, sensor platforms, as well as vibro-acoustic, dust, and radiation mitigation materials.



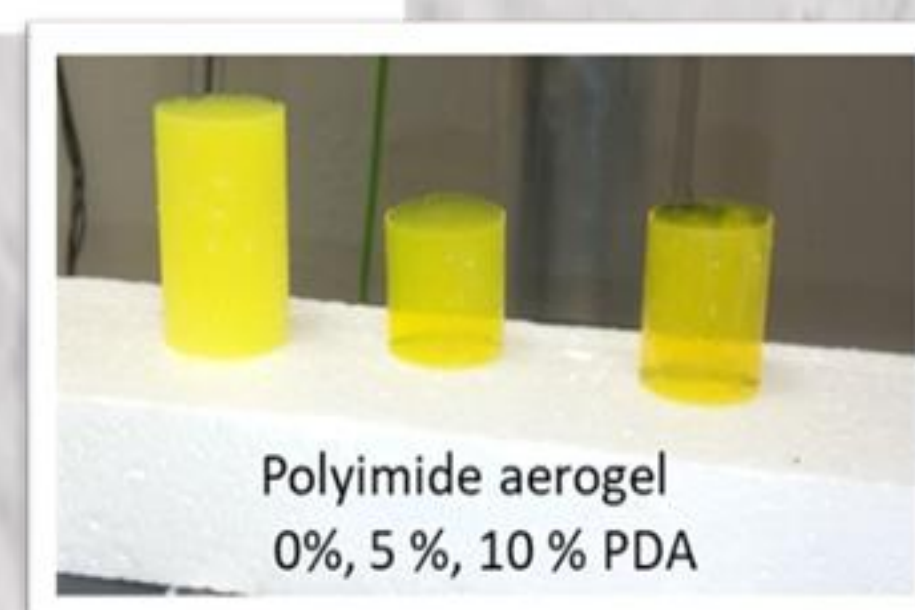
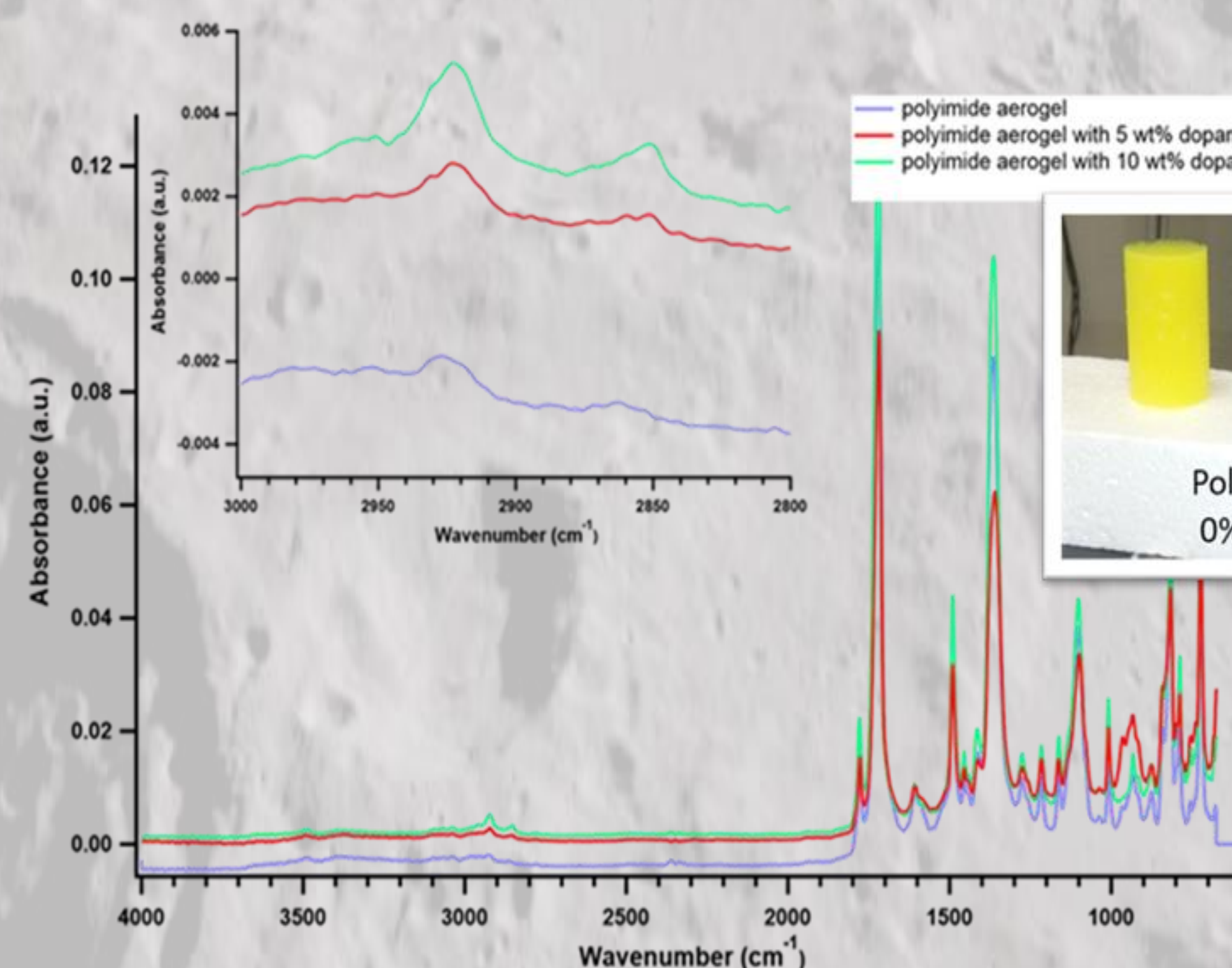
Melanized Aerogel for Radiation Mitigation



G.Rey, et al. ACS Appl. Mater. Interfaces 2021 13 (34), 41084-41093



SEM images of the surface morphology of native aerogel (a) and PDA coated aerogel at t=12 h (b) and t=24 h (c). Melanized aerogels exhibit higher absorption over native aerogel with little to no effect on surface area, density, shrinkage, and porosity



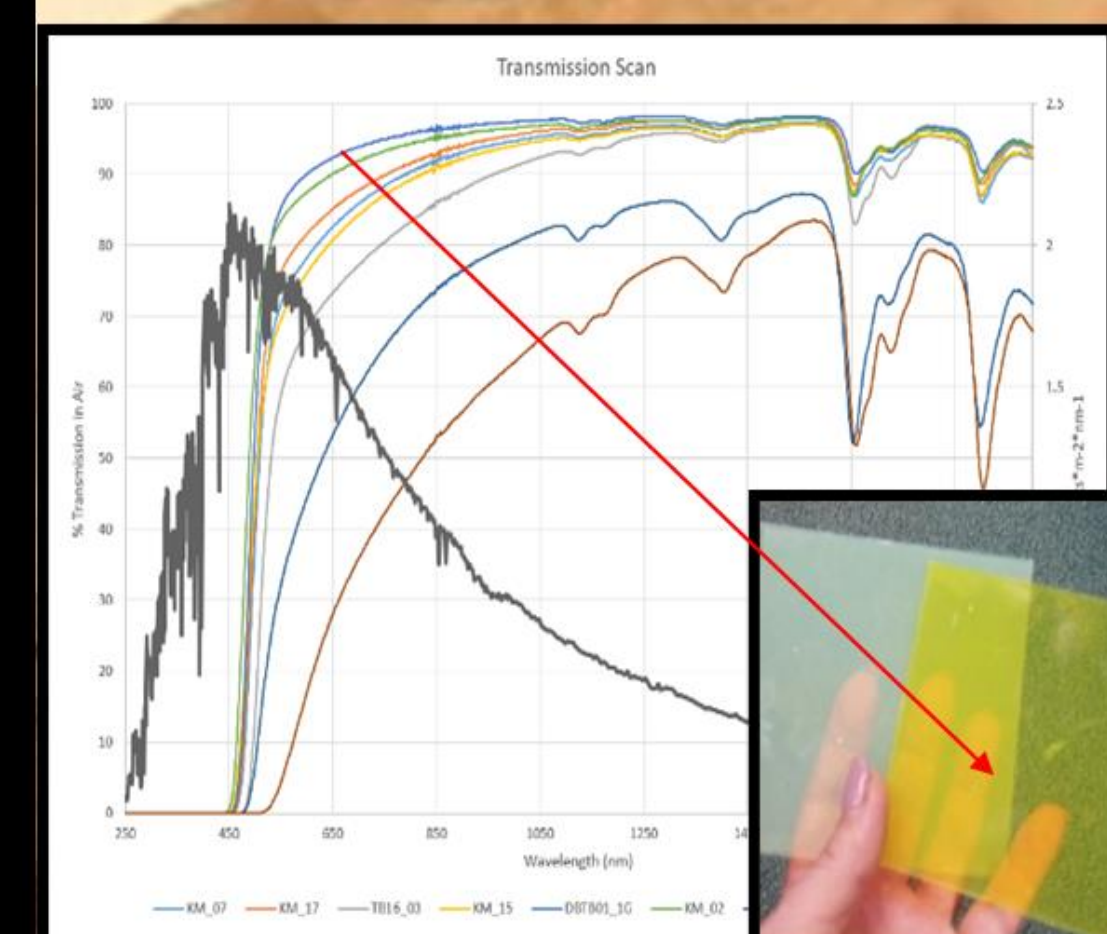
Polyimide aerogel 0%, 5 %, 10 % PDA

Radiation resistance and robust structural integrity was achieved by creating an aerogel with a conformal coating of a radiation mitigating polymer (melanin) throughout its underlying matrix

Polymer Aerogels for Passive Thermal Containment

Aerogels for Surviving the Lunar Night (ASLAN)

Tunable opacity



Higher transmissivity and optical clarity with fluorinated monomer



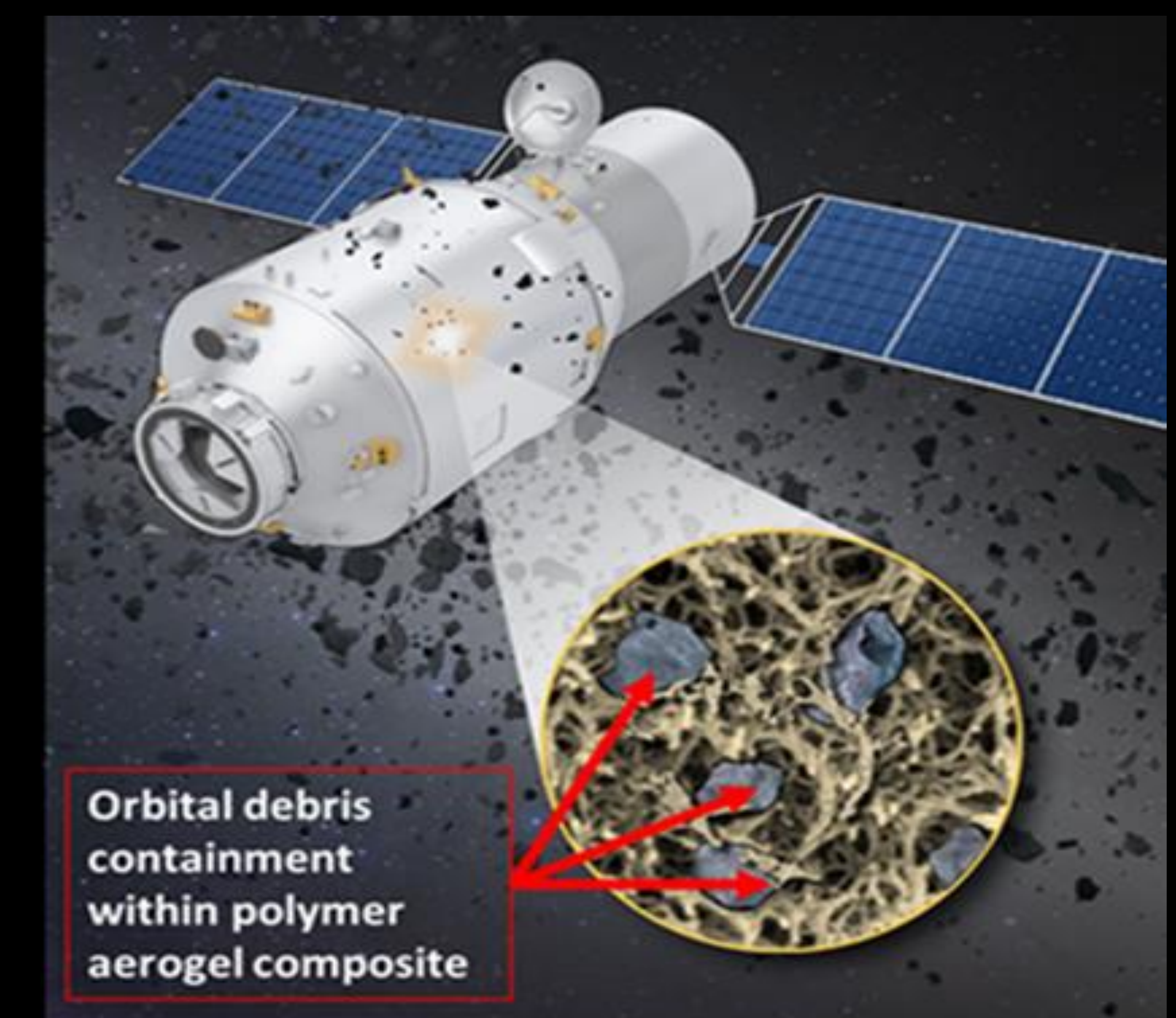
PTC for habitats, greenhouses, terraforming

Vivod, et al. ACS Appl. Mater. Interfaces 2020 (7) 8622-8633

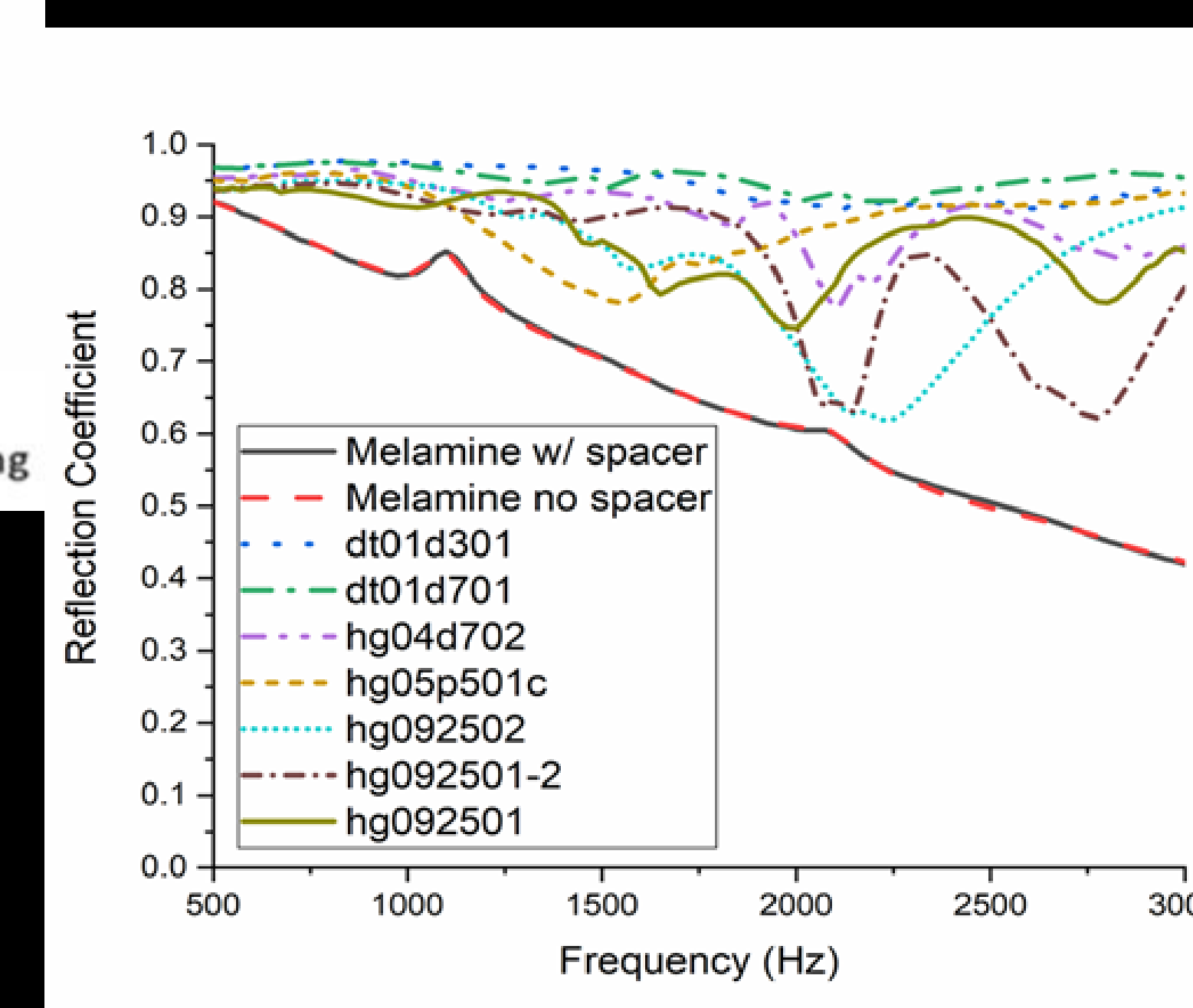
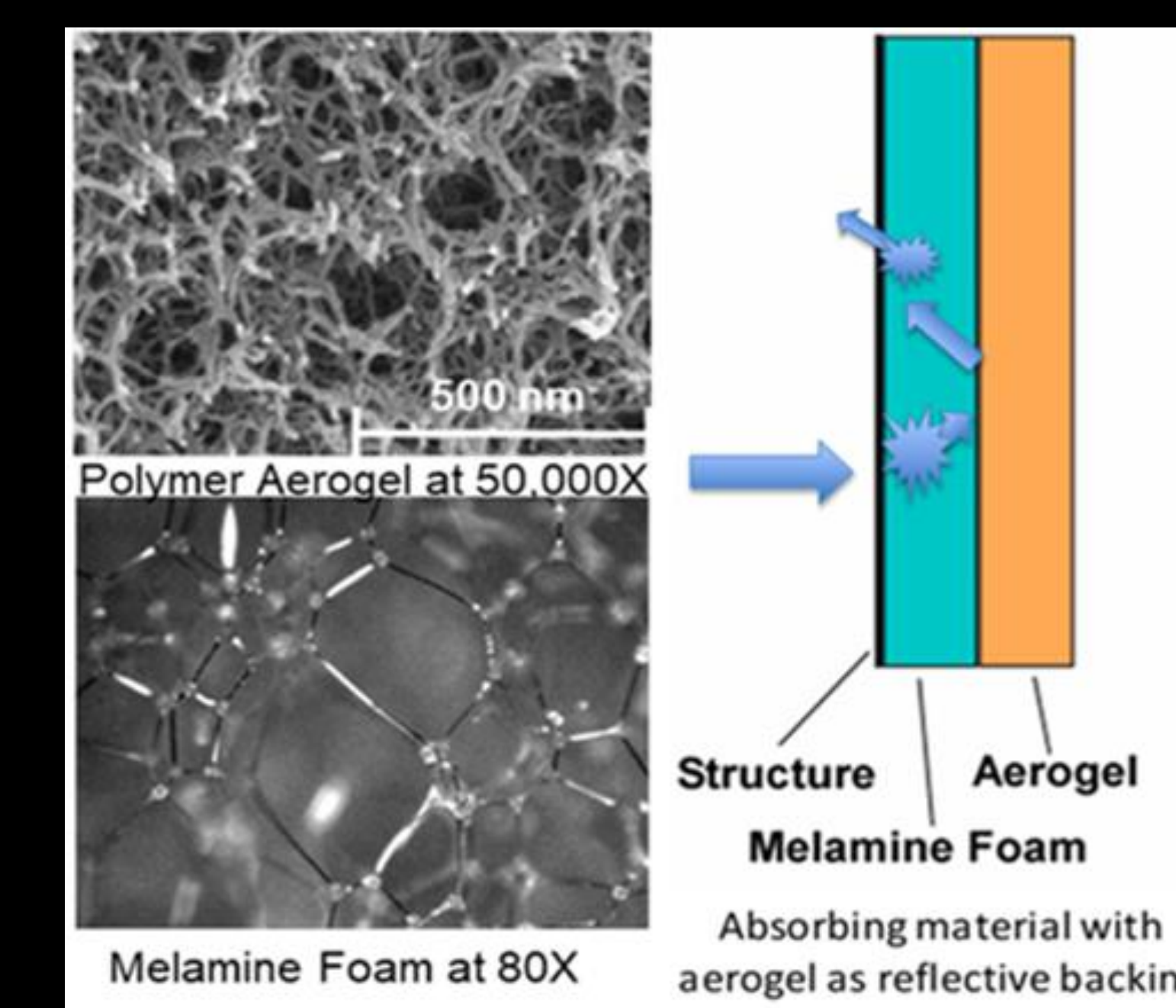
Passive radiative transfer to be able to heat an internal target while the polymer aerogel structure acts as a thermal trap similar to a greenhouse.



PI aerogel is 30-60 times more thermally insulating than glass at RT and ambient pressure



Orbital debris containment within polymer aerogel composite



Advanced Acoustic Materials for Noise Mitigation

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