

## **Porous, ultralow-temperature supercapacitors could power Mars, polar missions**

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A porous carbon aerogel improves the low-temperature performance of supercapacitors, which could help supply energy for space missions and polar activities. Credit: Adapted from *Nano Letters* 2021, DOI: 10.1021/acs.nanolett.0c04780



NASA's Perseverance Rover recently made a successful landing on Mars, embarking on a two-year mission to seek signs of ancient life and collect samples. Because Mars is extremely cold—nighttime temperatures can drop below -112 F—heaters are required to keep the rover's battery system from freezing. Now, researchers reporting in ACS' *Nano Letters* have 3D printed porous carbon aerogels for electrodes in ultralow-temperature supercapacitors, reducing heating needs for future space and polar missions.

Jennifer Lu, Yat Li and colleagues wanted to develop an <u>energy storage</u> <u>system</u> that could operate at very low temperatures without heating units, which add weight and <u>energy requirements</u> to instruments and machinery, such as the Mars rovers. So the researchers 3D printed a porous carbon aerogel using cellulose nanocrystal-based ink, and then freeze-dried it and further treated the surface.

The resulting material had multiple levels of pores, from the 500- $\mu$ m pores in the lattice-like structure, to nanometer-sized pores within the bars of the lattice. This multiscale porous network preserved adequate ion diffusion and charge transfer through an electrode at -94 F, achieving higher energy storage capacitance than previously reported low-temperature supercapacitors.

The team will collaborate with NASA scientists to further characterize the device's low-temperature performance.

**More information:** "Printing Porous Carbon Aerogels for Low Temperature Supercapacitors" *Nano Letters* (2021). pubs.acs.org/doi/abs/10.1021/acs.nanolett.0c04780

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