'Thermal switches' dynamically moderate heat of electronic devices

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Modern devices that use lithium ion batteries, like smartphones and electric cars, seem pretty robust. But try to use one in extreme heat or cold, and you'll see how susceptible they are to malfunctions and low

performance due to temperature. Purdue University engineers have developed a solution: a "thermal switch" made up of compressible graphene foam, that dynamically adjusts to temperatures both inside and outside the device to maintain consistent thermal management.

As the graphene foam compresses physically (from 1.2 millimeters to 0.2 millimeters), its thermal conductance goes up by a factor of 8. As a result, the amount of heat conducted out can be fully adjustable, according to temperature conditions both inside and outside the device, which improves performance and energy efficiency.

The Purdue researchers measured the thermal conductance of the foam at Purdue's Birck Nanotechnology Center. They sandwiched a 1.2-millimeter-thick sample of graphene foam in between a heater and heat sink, and placed the system under an infrared microscope to measure the temperature and heat flow. When fully compressing the foam to a thickness of 0.2 millimeters, the thermal conductance went up by a factor of 8. They then tested an experiment in a chamber at Purdue's Flex Lab that can create specific environmental conditions, and achieved similar results with ambient temperatures from 0° C (32° F) to 30°C (86° F).

More information: Tingting Du et al, Wide range continuously tunable and fast thermal switching based on compressible graphene composite foams, *Nature Communications* (2021). DOI: 10.1038/s41467-021-25083-8

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https://techxplore.com/news/2021-08-thermal-dynamically-moderate-electronic-devices.html