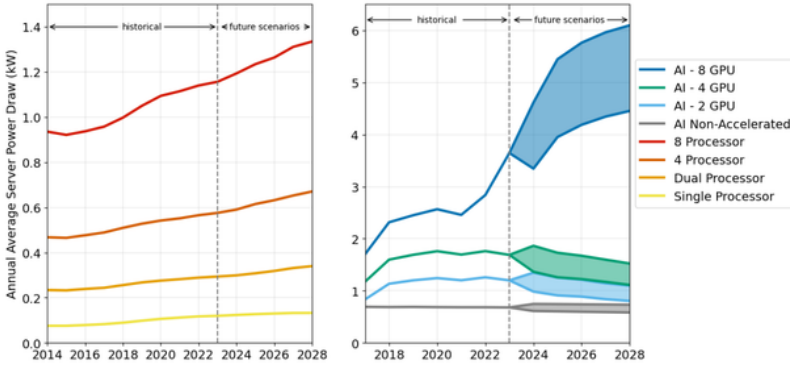


High-Performance Data Center Cooling using TPMS Lattice Structures

Team: Ryan Carpio-Brown, Teddy Holthaus, Ikechukwu Sunny-Odio, David Zhang
Advisors Brennan Birn, Yuxin Hu, Grace Gu, Peter Hosemann



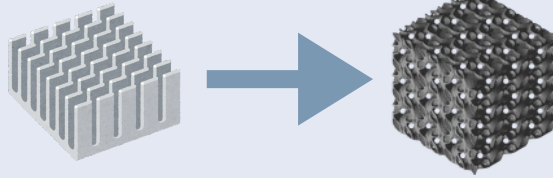
2024 United States Data Center Energy Usage Report
LBL Publications, 2024-12-20, 10.71468/P1WC7Q

Data centers are rapidly increasing their computational capacity, resulting in server rack **power densities doubling** or even tripling in the last few years.

As more power is used per server, **more heat is generated** in exceedingly small spaces. Operating data centers at sustained high temperatures can result in:

- Increased outages
- Higher operational costs
- Shorter hardware life cycles

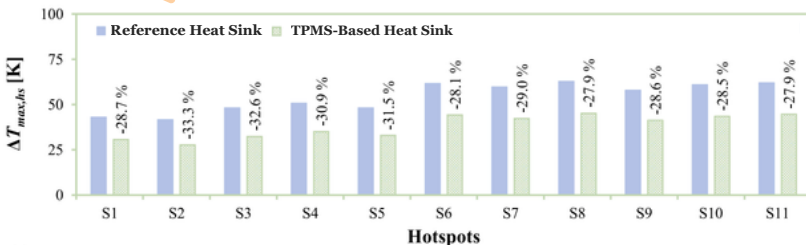
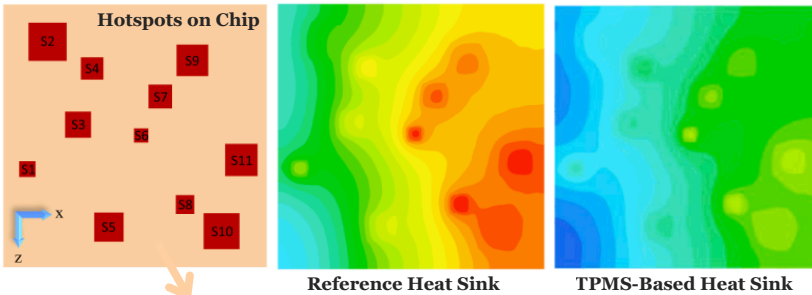
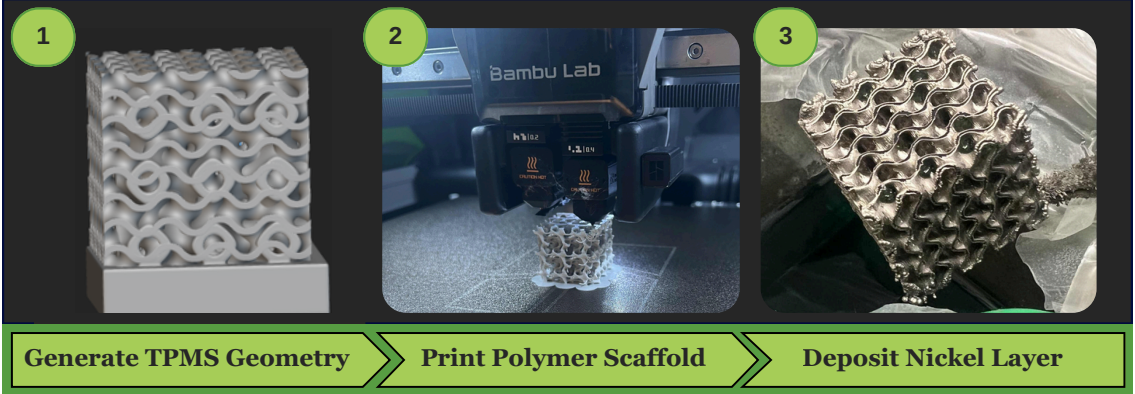
Today, server heat sinks utilize a series of pins to dissipate heat



Existing research demonstrates that **Triply Periodic Minimal Surface (TPMS)** Lattices offer superior heat dispersion characteristics.

Our Project:

We tested a scalable **electroplating** method for manufacturing TPMS lattices at low cost, **without sacrificing cooling performance.**



Results

Our TPMS heat sink **successfully reduced the hottest spots** on our test processor by approx. 30%, while utilizing a fraction of metal in manufacturing.

Therefore, TPMS heat sinks are proven to be a **strong contender for the future** of data center cooling systems.

FINAL DATA PENDING