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# Flash Boiling System for Rapid Cooling of Pulsed Heat Sources

**A high-conductivity graphitic carbon foam provides enhanced heat transfer and an additional cooling effect from fluid desorption, ideal for short-duration, high-power heating in electronics like directed energy weapons and industrial lasers.**

In many applications, especially high-power density electronics, thermal waste heat is a significant issue limiting device performance. Even when heating is relatively moderate, the efficiency of the cooling mechanism is often of significant concern since it represents a subsystem of the overall device, limiting performance due to factors such as energy usage, portability, and weight. For this reason, search in the thermal/fluids field has focused on finding cooling methods designed for very high heat flux to relatively low.

Researchers at Purdue University have developed a graphitic carbon foam to act as an extended surface to enhance the heat path from the high power device to the transient flow field. Despite the foam's porosity, they have exhibited excellent thermal conductivity, which can range from 40-150 W / mK depending on the density. An additional benefit to including a graphitized carbon foam is that we can expect some amount of adsorption to occur between the working fluid and the foam, and a cooling effect occurs when the fluid desorbs from the surface of the solid. This desorption process will enhance the cooling effect already provided by the flash boiling of the liquid phase. This technology is particularly applicable to short-duration, high-power heating events commensurate with directed energy weapons, high-power radar, industrial lasers, and potentially regenerative breaking.

**Advantages**:

-Excellent thermal conductivity

-Additional cooling effect from desorption

Potential Applications:

**Technology ID**

2015-FISH-67229

**Category**

Aerospace & Defense/Thermal Management & Combustion Optimization

Materials Science & Nanotechnology/Thermal Management Materials & Solutions

Semiconductors/Thermal Management & Cooling Technologies

**Authors**

Jeffrey Engerer

Timothy Fisher

**Further information**

Dipak Narula

dnarula@prf.org

**View online**

-Directed energy weapons

-High-power radar

-Industrial lasers

**TRL:** 4

**Intellectual Property:**

Provisional-Patent, 2015-09-17, United States | Utility Patent, 2016-09-19, United States | CON-Patent, 2020-04-04, United States

**Keywords:** Graphitic carbon foam, thermal waste heat, high-power density electronics, cooling mechanism, high heat flux, extended surface, thermal conductivity, desorption cooling, flash boiling, directed energy weapons, Energy, Lasers, Mechanical Engineering, Thermoelectric, Weapons