

Method for Making Thermally Conductive Materials

A method for the production of nanostructured surfaces and bulk composite materials that exhibit tunable surface morphology

Georgia Tech inventors have developed a method for the production of conjugated polymer based nanostructured surfaces and bulk composite materials that exhibit tunable surface morphology, wettability, enhanced electrical conductivity, thermal conductivity, and total thermal resistance. The nanostructured surfaces are produced via a template assisted fabrication approach using nanoporous templates. Super-hydrophobic surfaces are created, and the control over surface morphology and wettability is achieved by selective template etching. Amorphous polymer nanofibers are produced with thermal conductivities 20 times higher than the conventional bulk polymer material. Certain polymer nanofiber materials maintain their thermal conductivity up to at least 200 C. The arrays of polymer nanostructures are chemically, mechanically, and thermally robust and serve as soft substrates with heat dissipation capability for the fabrication of thermal management materials and tunable wetting for microfluidic applications. Methods are introduced to embed the nanofiber arrays in bulk polymer films to create hierarchical composite structures for use as flexible thermal management substrates, or ordered heterojunction organic photovoltaic cells.

Summary Bullets

- Property tuning capability
- Improved surface wettability and electrical conductivity which improved alignment of polymer chains
- Increased thermal capability

Solution Advantages

- Property tuning capability
- Improved surface wettability and electrical conductivity which improved alignment of polymer chains
- Increased thermal capability
- Increased precise control of the nanotube surface morphology

Potential Commercial Applications

- Organic photovoltaic devices
- Microfluidic devices used in biological and other fluid transport applications

- Electrically insulation flexible substrates with thermal dissipation

Background and More Information

Polymers are often considered thermal insulators due to the amorphous arrangement of molecular chains, reducing the path of heat-conducting phonons. The most common method to increase thermal conductivity is to draw polymeric fibers, which increase chain alignment and crystallinity. Unfortunately, the material created from this process currently has limited thermal applications. Several thermal interface applications include material systems for biocompatible microfluidic devices, composite structures for organic photovoltaic applications, and substrate materials for thermally conductive flexible substrates for electrical devices, such as LEDs. To maximize the performance and use of polymer materials in thermal applications, improvements in the thermal conduction, mechanical compliance, and electrical insulation properties of polymers need to be made.

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IP Status

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Publications

[GEEKOUT: Heating Up the Energy Sector with Baratunde Cola](#), -

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