

An Advanced and High Strength Thermal Interface Material

Track Code: 2013-FISH-66462

Categories:

- Materials and Manufacturing

Keywords:

- Carbon Nanotubes
- Materials and Manufacturing
- Mechanical Engineering
- Nanomaterials
- Thermoelectric

Carbon nanotubes (CNT) are nanomaterials that are being intensely investigated as thermal interface materials due to their high conductivity, but their use has been limited in part due to ineffective methods of bonding them to other materials. This limitation is caused by CNT's instability at high temperatures, so they are generally used in conjunction with soldering, which is performed at lower temperatures. Unfortunately, soldering provides only minimal bonding strength, has low resistance to corrosion, and cannot withstand high temperatures.

Researchers at Purdue University have developed a technique to bond CNTs to other materials using brazing, a much stronger and suitable bonding method than soldering. Like soldering, brazing connects materials using a melted filler alloy, but the brazing alloys melt at much higher temperatures, creating bonds far stronger than those using soldering. In order to withstand the high temperatures of this process, the CNT must first be treated with a process, such as a boron-nitrate treatment, also developed by Purdue researchers. The pretreatment increases the CNT's low wettability with other materials, helping increase the strength of the bond. Brazing can be used to join different layers of thermoelectric modules (TEMs) that operate in high temperatures. The enhanced thermal conductivity and lowered thermal interface resistance of the brazing layer help to maximize the power output of the resulting TEM.

Advantages:

- Greater bond strength
- Increased thermal conductivity and lowered thermal resistance between bonded materials.

Potential Applications:

- Materials engineering
- Thermoelectrics

People:

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Intellectual Property:

Application Date: March 14, 2016

Type: Utility Patent

Country of Filing: United States

Patent Number: 10,406,636

Issue Date: September 10, 2019

Application Date: March 12, 2015

Type: Provisional-Patent

Country of Filing: United States

Patent Number: (None)

Issue Date: (None)

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