Covalently Bonded Graphene-Carbon Nanotube Hybrid for High-Performance Thermal Interfaces - DTU Orbit (08/11/2017)

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The remarkable thermal properties of graphene and carbon nanotubes (CNTs) have been the subject of intensive investigations for the thermal management of integrated circuits. However, the small contact area of CNTs and the large anisotropic heat conduction of graphene have hindered their applications as effective thermal interface materials (TIMs). Here, a covalently bonded graphene–CNT (G-CNT) hybrid is presented that multiplies the axial heat transfer capability of individual CNTs through their parallel arrangement, while at the same time it provides a large contact area for efficient heat extraction. Through computer simulations, it is demonstrated that the G-CNT outperforms few-layer graphene by more than 2 orders of magnitude for the c-axis heat transfer, while its thermal resistance is 3 orders of magnitude lower than the state-of-the-art TIMs. We show that heat can be removed from the G-CNT by immersing it in a liquid. The heat transfer characteristics of G-CNT suggest that it has the potential to revolutionize the design of high-performance TIMs.

General information

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, ETH Zurich
Authors: Chen, J. (Ekstern), Walther, J. H. (Intern), Koumoutsakos, P. (Ekstern)
Pages: 7539-7545
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Advanced Functional Materials
Volume: 25
Issue number: 48
ISSN (Print): 1616-301X
Ratings:

Web of Science (2017): Indexed Yes

Scopus rating (2016): CiteScore 11.56

Web of Science (2016): Indexed yes

Scopus rating (2015): CiteScore 11.93

Web of Science (2015): Indexed yes

Scopus rating (2014): CiteScore 11.32

Web of Science (2014): Indexed yes

Scopus rating (2013): CiteScore 10.6

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

Scopus rating (2012): CiteScore 10.41

ISI indexed (2012): ISI indexed yes

Scopus rating (2011): CiteScore 9.47

ISI indexed (2011): ISI indexed no

Web of Science (2010): Indexed yes

Web of Science (2009): Indexed yes

Web of Science (2008): Indexed yes

Web of Science (2007): Indexed yes

Original language: English
DOIs:

10.1002/adfm.201501593

Source: FindIt
Source-ID: 2289061026
Publication: Research - peer-review › Journal article – Annual report year: 2015