Proceedings of the

NATIONAL CONFERENCE ON MULTIDISCIPLINARY RESEARCH 2020

VIRTUAL POSTGRADUATE SYMPOSIUM

"Inspiring Sri Lankan Youth for Tomorrow's Science"

NCMR 2020

08th October 2020

ORGANIZED BY THE YOUNG SCIENTISTS' ASSOCIATION, NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES, SRI LANKA

NIFS

NIFS-YSA

Main Sponsor: BANK OF CEYLON BOC Bankers to the Nation

ISSN 2756-9063
Proceedings of the National Conference on Multidisciplinary Research-2020
Young Scientists' Association, National Institute of Fundamental Studies, Sri Lanka
October 08, 2020

Analysis of effective thermal conductivity in suspended and supported graphene: Representative volume element approach

R.A. Rathnayake[1,2], H. Wijekoon[1,2], N.D. Subasinghe[1*]

[1]*National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka*
[2]*Postgraduate Institute of Science, University of Peradeniya, Sri Lanka*

[*]*deepal.su@nifs.ac.lk*

Graphene, the miracle material of the 21st century, has emerged as one of the most promising nanomaterials because of its unusual combination of superb properties. It can be used as a serious alternative to replace many standard materials for various applications. Nowadays, graphene is identified as an excellent thermoelectric material in the field of thermoelectricity. Anyhow, if such material is determined to be used as a thermoelectric material, it should have a high Seebeck coefficient and excellent electrical conductivity as well as low thermal conductivity. Suspended monolayer graphene has a high electrical conductivity value up to 240000 $\Omega^{-1}\,m^{-1}$ and a high thermal conductivity value between 3000-5300 $W\,m^{-1}\,K^{-1}$. Thus, the noted problem here is this high thermal conductivity value makes it unfit for use as a thermoelectric material. Based on previously reported work, the reduction of thermal conductivity when a few layers of graphene supported on a SiO_2 substrate, we developed an analytical model to predict the effective thermal conductivity of supported graphene. The analytical model is developed based on the concept of Representative Volume Element (RVE), which is widely used to determine the effective material properties of nano-structured materials. This model was validated using extensive molecular dynamics (MD) simulations in our previous work. Then, the results were compared with the previously developed RVE model for suspended graphene, and the dramatic reduction of thermal conductivity of supported graphene was observed.

Keywords: *representative volume element, supported graphene, thermal conductivity, thermoelectricity*