

Han-Ching Chung¹

Kai-Wei Chen¹, Jian-Jhih Ciou¹, Chien-Liang Tu¹, Chia-Lin Chen², Wei-Tsai Chang², Chang-Hsiao Chen^{1,*}

¹Department of Automatic Control Engineering, Feng Chia University, Taichung, Taiwan, R.O.C.

²Optoelectronic & Semiconductor Equipment Components Localization Office, Metal Industries Research and Development Center, Kaohsiung, Taiwan, R.O.C.

chsiaoc@fcu.edu.tw

Heat Dissipation from Copper Vapor Chamber by CVD Graphene

Vapor chamber are planar heat pipes that spread heat from smaller, concentrated heat source to heat sink. The vapor chamber usually made of copper (Cu) which has a high thermal conductivity. It was used to spread heat out rapidly over the chamber and more effectivity transfer into the secondary heat exchanger. Suspend graphene is known to have usually high intrinsic thermal conductivity, which is as high as 5300 W/m-K [1]. However, graphene placement on substrates results in degradation of thermal conductivity owing to phonon scattering on the substrate defects and interface [2]. Balandin et al. have demonstrated experimentally that graphene-Cu heterogeneous films reveal strongly enhanced thermal conductivity as compared to the reference Cu foil, which increases thermal conductivity by up to 24% [3]. In this paper, we used chemical vapor deposition (CVD) process to synthesize graphene on copper vapor chamber directly. The graphene-Cu composite vapor chamber enhances the thermal conductivity and heat dissipation properties. Besides, the graphene serves as a protection layer to prevent the reaction between Cu and the ambient environment. Figure 1 shows the schematic for the heat dissipation measurement of the stacked graphene-Cu vapor chamber, where a heat source equipped with a 15 W light emitting diode (LED) and thermocouple is used for probing the temperature signal of the center position of LED. It was noticed that the CVD graphene-Cu vapor chamber, which the temperature of the LED can be reduced by $\sim 20^{\circ}\text{C}$. It shows that graphene-Cu can spread more heat than Cu as the same time.

References

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Figures

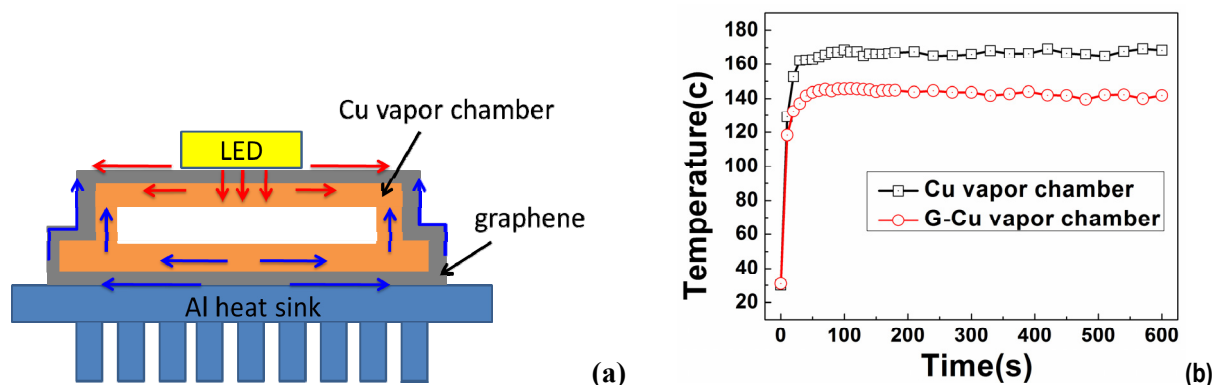


Figure 1: (a) Schematic illustration of the heat dissipation using a 15 W LED, Al heat sink and the graphene-Cu vapor chamber. (b) The equilibrium temperature of LED mounts on Cu and graphene-Cu vapor chamber.