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Metal-Insulator Transition effect on Graphene/VO₂ via temperature dependent Raman Spectroscopy

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Vanadium dioxide (VO₂) is a material which has a special characteristic that can change its properties drastically called metal-Insulator transition (MIT). The MIT of VO₂ occurs at temperature about 68°C under atmospheric pressure which change its phase from monoclinic to rutile phase, result in their different properties and structure. This characteristic of VO₂ can be used for application such as smart windows[1]. Moreover, some material can be used to improve VO₂ film quality. In this work, bilayer-graphene were deposited on top of VO₂/Al₂O₃ of 50 nm and 100 nm VO₂ and were studied via temperature-dependent Raman spectroscopy technique. The results from Raman spectrum indicate that the lattice parameter mismatch between bilayer-graphene and VO₂ induce compressive strain on graphene and in-plane tensile strain on VO₂ according to the observed blue shift of VO₂ Raman modes. From the temperature-dependent Raman results, the monoclinic VO₂ Raman peaks diminished as temperature reach 60-65°C while the TMIT measured by temperature dependent resistance of bare VO₂ is equal to 70°C. Moreover, an unexpected behavior from graphene can be observed in graphene/VO₂. For graphene/SiO₂ G-peak position tends to red shift as temperature increase[3]. However, the G-peak position observed from graphene/VO₂ structure begins with red shift and turn to blue shift at ~60°C instead of only red shift.

References

- [1] Y. Cui, Y. Ke, C. Liu, Z. Chen, et al. Thermochromic VO₂ for Energy-Efficient Smart Windows. *Joule*, Volume 2, Issue 9-2018, 1707-1746. <https://doi.org/10.1016/j.joule.2018.06.018>
- [2] Zhou, H., Li, J., Xin, Y., Cao, X., Bao, S., and Jin, P. (2015). Enhanced optical response of hybridized VO₂/graphene films. *J. Mater. Chem. C*, 3(19), 5089-5097. doi:10.1039/C5TC00448A
- [3] Wang, W., Peng, Q., Dai, Y. et al. Temperature dependence of Raman spectra of graphene on copper foil substrate. *J Mater Sci: Mater Electron* 27, 3888–3893 (2016). <https://doi.org/10.1007/s10854-015-4238-y>

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