

# Ion-energy-controlled deposition of amorphous carbon films as adhesive interlayers for display application

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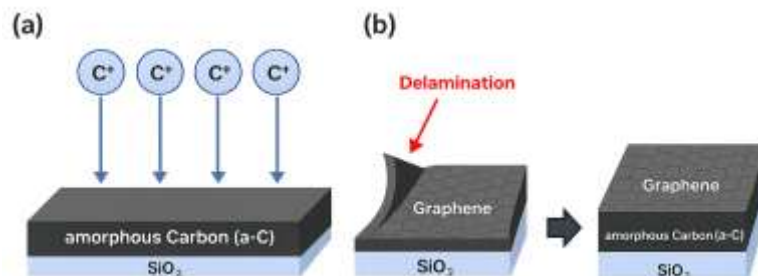
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Interfacial properties between graphene and substrates are critically important in graphene-based flexible nanoelectronic device applications [1]. However, conventional graphene/SiO<sub>2</sub> interfaces rely on weak van der Waals interactions, which often lead to mechanical delamination and device instability [2,3]. In this study, we introduce an ion-energy-controlled amorphous carbon (a-C) interlayer as a platform to enhance the adhesion between graphene and substrates. Preliminary experiments, in which the PECVD process pressure was systematically controlled, show that decreasing the deposition pressure results in an increase in the sp<sup>2</sup> bonding fraction from 89.38% to 91.67%. This result demonstrates that a sp<sup>2</sup>-rich structure is a key factor in improving interfacial adhesion at graphene/substrate interfaces [4,5]. Further studies are ongoing to establish the correlation between the sp<sup>2</sup>/sp<sup>3</sup> ratio and adhesion strength through systematic parameter sweeps. This work presents a strategy for improving the interfacial integration of graphene with flexible substrates using carbon-based interlayers, with potential applications in next-generation flexible and wearable electronic devices.

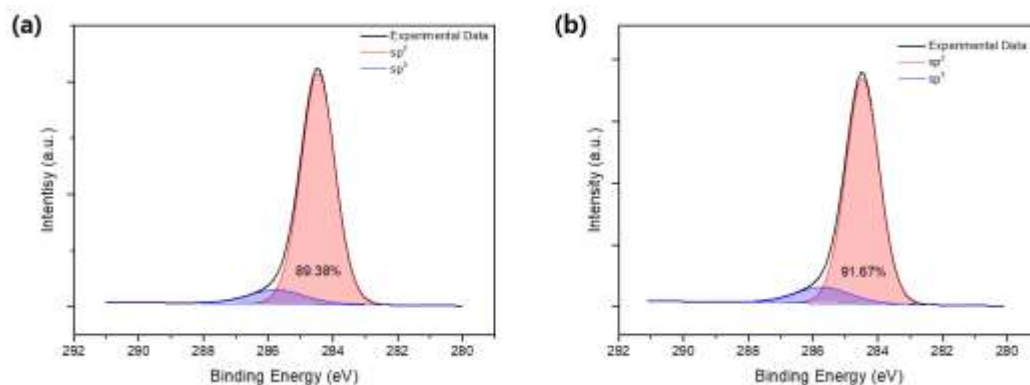
## References

- [1] K. S. Kim *et al.*, *Nature*, 457 (2009) 706-710
- [2] W. Gao *et al.*, *J. Phys. D: Appl. Phys.*, 47 (2014) 255301
- [3] S. P. Koenig *et al.*, *Nature Nanotech.*, 6 (2011) 543-546
- [4] A. C. Ferrari *et al.*, *Phys. Rev. B*, 61 (2000) 14095-14107
- [5] J. Robertson, *Mater. Sci. Eng. R*, 37 (2002) 129-281

## Figures



**Figure 1:** Schematic illustration of (a) ion-energy-controlled a-C formation and (b) adhesion enhancement via a-C interlayer



**Figure 2:** C 1s XPS spectra of amorphous carbon films deposited under different PECVD pressure conditions: (a) high-pressure condition (100 mTorr) and (b) low-pressure condition (20 mTorr)