Selective etching of single-layer graphene by excimer UV and its application in FET devices

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Since the discovery of graphene and its remarkable properties, researchers have actively explored advanced graphene-patterning technologies. While the etching process is pivotal in shaping graphene channels, existing etching techniques have limitations such as low speed, high cost, residue contamination, and rough edges. Therefore, the development of facile and efficient etching methods is necessary. This study entailed the development of a novel technique for patterning graphene through dry etching, utilizing selective photochemical reactions precisely targeted at single-layer graphene (SLG) surfaces. This process is facilitated by an excimer ultraviolet lamp emitting light at a wavelength of 172 nm. The effectiveness of this technique in selectively removing SLG over large areas, leaving the few-layer graphene intact and clean, was confirmed by various spectroscopic analyses.

Furthermore, we explored the application of this technique to device fabrication, revealing its potential to enhance the electrical properties of SLG-based devices. One-dimensional edge contacts fabricated using this method not only exhibited enhanced electrical transport characteristics compared to two-dimensional contact devices but also demonstrated enhanced efficiency in fabricating conventional 1D- contacted devices. This study addresses the demand for advanced technologies suitable for next-generation graphene devices, providing a promising and versatile graphene-patterning approach with broad applicability and high efficiency.

References

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Figures

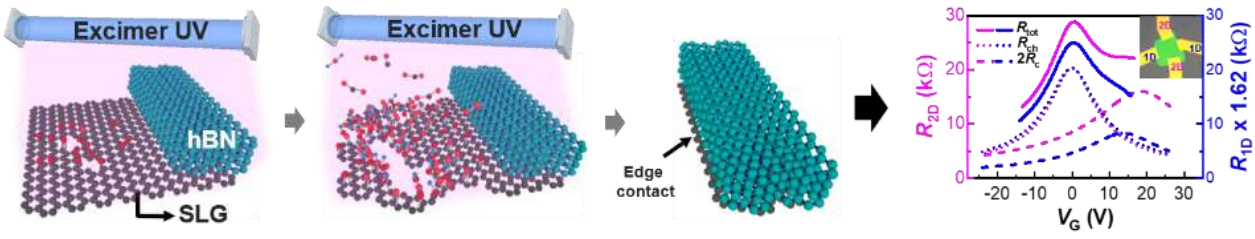

Figure 1: The schematics of fabricating hBN/SLG-based device with edge-contact by excimer UV and its electrical property. It shows SLG etching process under the ambient condition and its improved performance of 1D contact device than 2D contact device.