

Light-mediated degrafting of covalently anchored moieties from the graphene surface

Muhammed Shameem K. M., Mathias Wolf, Kunal Mali, Steven De Feyter, Hiroshi Uji-i
Department of Chemistry, Division of Molecular Imaging and Photonics, KU Leuven
Muhammedshameem.km@kuleuven.be

Light-mediated controlled covalent grafting and degrafting of functional moieties on the basal plane of graphene have become increasingly popular for devising different graphene substrates for future high-performance devices.¹ The photo-cleavage (degrafting) results in the removal of the addend from the graphene and will yield the re-establishment of the pristine structure (sp^3 to sp^2) without even a point defect. However, we observe that a structural modification occurs during the photo-cleavage of covalently anchored phenyl derivatives from a single layer of graphene sheet at ambient conditions.² The modification has been characterized by confocal micro-Raman spectroscopy and AFM technique. The time-dependent Raman spectrum reveals two distinct features during the photo-cleavage especially when the intensity crosses a threshold of 6 MW/cm^2 : an unusual broadening of the D band together with the enhancement of G band intensity at the initial stages, while the redistribution of these intensities occurs at later timescale. The combined time-dependent Raman and AFM measurements suggest that laser-induced damage occurs at the highly irradiated region, which subsequently generates amorphous carbon through carbonization of the aryl functional group and graphene.^{3,4} On the other hand, molecular desorption dominates in the surrounding less irradiated area. These observation has been validated with different excitation wavelength, power, and time. Furthermore, the AFM analysis also manifests how the heat is being transported to the surrounding area in a single-layer graphene sheet.

References

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