

Raman Study of Spatially Controlled Covalent Functionalization on (6,5)-SWCNT Films

Johanna Krüger¹

Sebastian S. Lindenthal,² Simon Wald,² Jana Zaumseil,² Andreas Hirsch,¹ and Frank Hauke¹

¹Department of Chemistry and Pharmacy & Center of Advanced Materials and Processes (ZMP)
Friedrich-Alexander University of Erlangen-Nürnberg

Dr.-Mack-Strasse 81, 90762 Fürth, Germany

²Institute for Physical Chemistry

Ruprecht-Karls-University of Heidelberg

Im Neuenheimer Feld 253, 69120 Heidelberg, Germany

johanna.krueger@fau.de

Modifying graphene via covalent functionalization by introducing various organic moieties and therefore tuning its chemical, electronic, and physical properties has established itself as a key field in graphene research.^[1] Modern laser writing techniques, which combine highly efficient, covalent functionalization with precise spatial resolution, allows for a dimensional and quantitative control over the addend binding.^[2] For the first time, we successfully established a new laser writing protocol on a 'quasi' two dimensional substrate supported thin film of monochiral (6,5)-single-walled carbon nanotubes (SWCNTs). Visible laser irradiation induces radical formation from three different organic precursors, enabling localized covalent functionalization along the laser path. The process is monitored by scanning Raman microscopy (SRM) via the I_D/I_{G+} ratio, confirming spatially resolved defect formation.^[3] This approach provides a direct route to pattern functional architectures on SWCNT films, opening new opportunities for their integration into optoelectronic devices.

References

- [1] T. Wei, F. Hauke, A. Hirsch, *Adv. Mater.*, 33 (2021), 2104060.
- [2] J. Krüger, T. Nagel, B. Yang, F. Hauke, A. Hirsch, *Chem. Eur. J.*, 31 (2025), e02468.
- [3] J. Krüger, S. S. Lindenthal, S. Wald, J. Zaumseil, A. Hirsch, F. Hauke, manuscript in preperation.

Figures

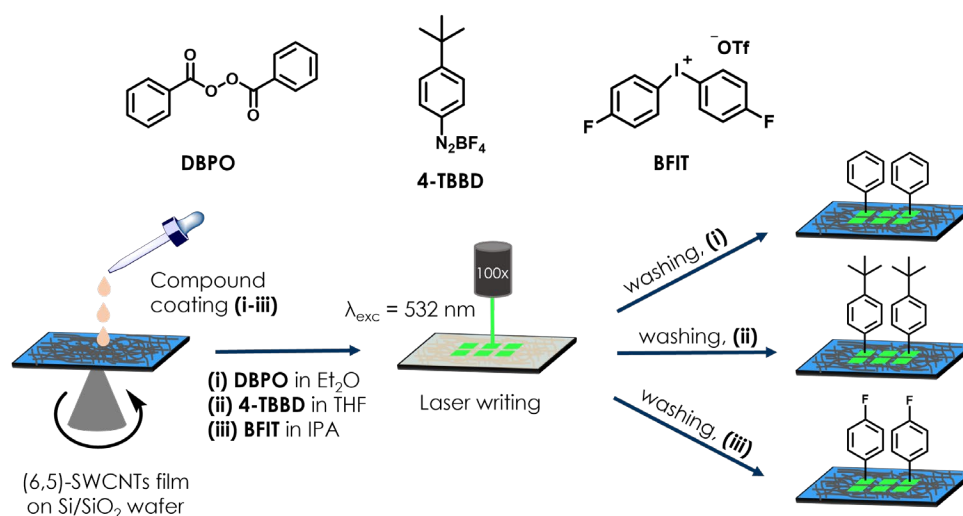


Figure 1: Schematic representation of the laser writing procedure on (6,5)-SWCNTs films on Si/SiO₂ substrate using DBPO, 4-TBBD, and BFIT as organic precursors.