Photothermal Bottom-up Graphene Nanoribbon Growth Kinetics

Yannic Falke
Boris V. Senkovskiy, Niels Ehlen, Alexander Grueneis *et al.*
University of Cologne, Condensed Matter Physics, Zuelpicher Str. 77, Cologne, Germany
falke@ph2.uni-koeln.de

We present laser-induced photothermal synthesis of atomically precise graphene nanoribbons (GNRs). The kinetics of photothermal bottom-up GNR growth are unravelled by in situ Raman spectroscopy carried out in ultrahigh vacuum. We photothermally drive the reaction steps by short periods of laser irradiation and subsequently analyze the Raman spectra of the reactants in the irradiated area. Growth kinetics of chevron GNRs (CGNRs) and seven atoms wide armchair GNRs (7- AGNRs) is investigated. The reaction rate constants for polymerization, cyclodehydrogenation, and interribbon fusion are experimentally determined. We find that the limiting rate constants for CGNR growth are several hundred times smaller than for 7-AGNR growth and that interribbon fusion is an important elementary reaction occurring during 7- AGNR growth. Our work highlights that photothermal synthesis and Ultra High Vacuum (UHV) Raman spectroscopy are a powerful tandem for the investigation of on-surface reactions.[1]

References

[1] Yannic Falke *et al.*, Nano Lett. (**2020**), 20, 7, p.4761 – 4767.

Figures

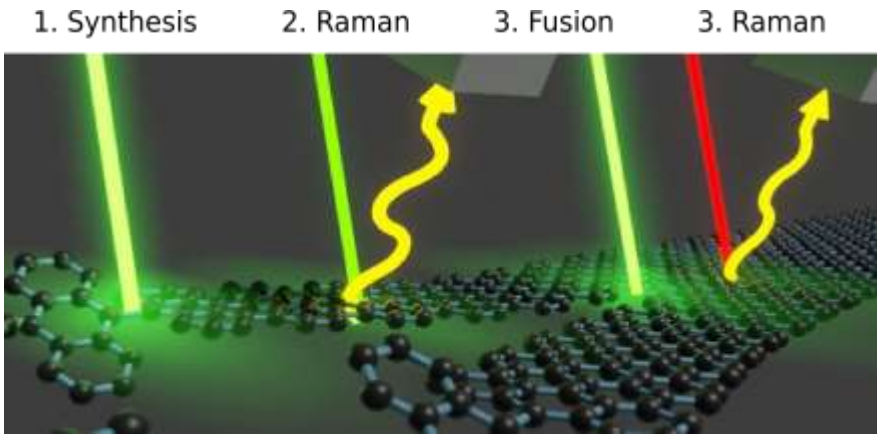

Figure 1: Sketch showing the basic principle of the experiment, including laser induced synthesis from organic precursors to 7-AGNRs, Raman measurement and fusion to 14-AGNRs.