Towards programmable synthesis of precise graphene nanoribbons

Adrián M.Abelairas
Jesús Mosquera, Alejandro Criado
CICA - Centro Interdisciplinar de Química e Bioloxía, Facultade de Ciencias, Universidade da Coruña, Campus de Elviña 15071, A Coruña, Spain
adrian.martinez.abelairas@udc.es

Abstract
The structural precision of graphene nanoribbons (GNRs) plays a pivotal role in determining their magnetic, optical, and electronic properties, which are particularly sensitive to the presence of defects. Structural variations can significantly reduce thermal and electrical conductance, key parameters for their application in nanoelectronics.[1]
In this work, we present a solution-phase synthesis of GNRs using an iterative Suzuki–Miyaura cross-coupling strategy. A central feature of this methodology is the use of nitro functional groups, which can be selectively transformed into aryl iodides that are highly reactive intermediates in cross-coupling reactions.[2] This transformation provides a robust and flexible strategy for masking halogen reactivity until needed. It enables a modular and programmable approach to nanoribbon construction, allowing precise sequence control and efficient chain extension through iterative coupling.
This strategy will permit the formation of monodisperse yet structurally diverse GNRs, enabling fine-tuning of their electronic properties and expanding their potential for integration into electronic devices. Moreover, the flexibility and orthogonality of the nitro-group masking strategy make this approach particularly well-suited for future automatization in nanographene synthesis.

References

[1] A. Lennox, G. Lloyd-Jones, Chem Soc. Rev., 43, (2014), 412-443.
[2] K.-R. Wee , W.-S. Han , J.-E. Kim , A.-L. Kim , S. Kwon and S. O. Kang , J. Mater. Chem., 21, (2011),1115.

Figure

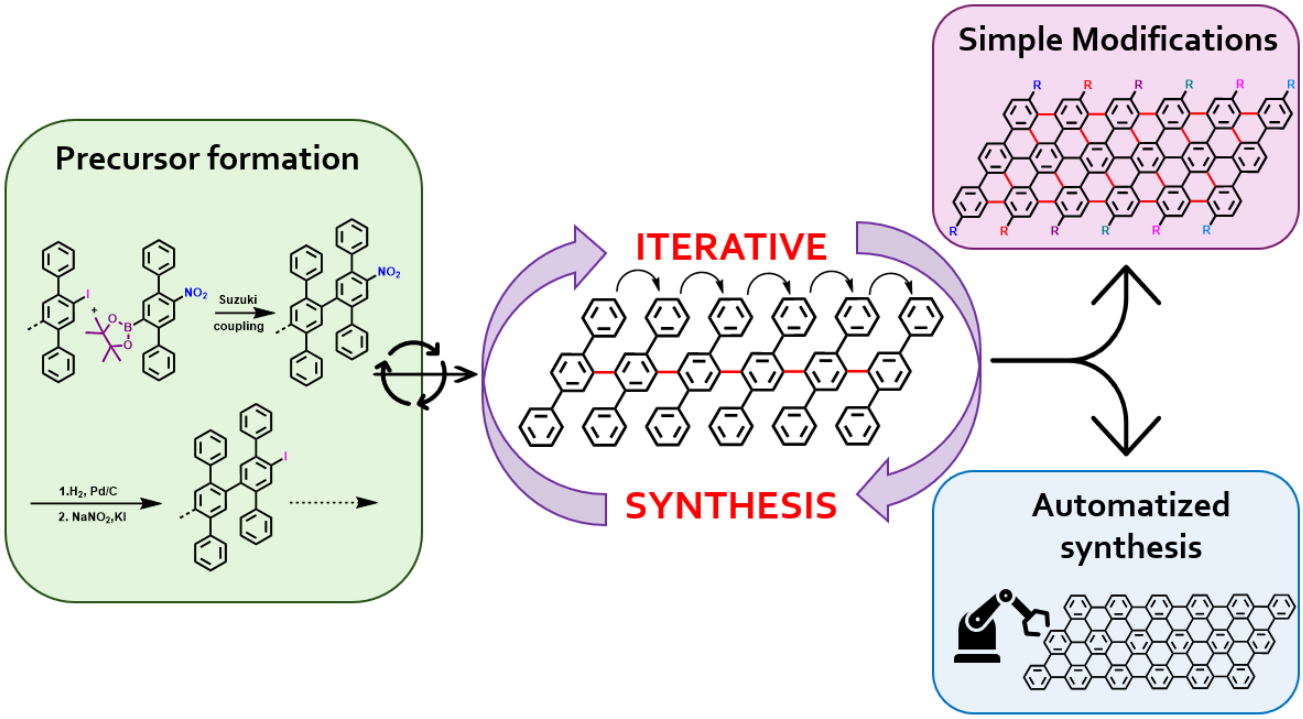

Figure 1: Diagram illustrating the procedure followed and highlighting its key advantages.