

## Synthesis of Asymmetrically Substituted Graphene Nanoribbons as a Functional Material

(Institute of Advanced Energy, Kyoto University) ○Karan Patel, Shunpei Nobusue, Shuang Li, Hiroshi Sakaguchi,

**Keywords:** Graphene Nanoribbon; Asymmetrical Structure; Edge Functionalization; Dehydrogenation; Head-to-tale Polymerization

Graphene nanoribbons (GNR) which have planar one-dimensional conformation of carbon exhibit unique properties<sup>1</sup> when related to their edge morphology, and eminently, several theoretical predictions have been made to change the properties of these systems through edge modifications. Introduction of different functional groups to the edges of GNR backbone would offer a promising strategy to exhibit new properties. This approach, however, has remained unexplored.

Previously, we have reported the efficient on-surface synthesis of acene-type GNR from the Z-shaped precursor, which consists of two terphenyl units, by chemical vapor deposition.<sup>1</sup> Inspired by this work, we hypothesized that the Z-shaped asymmetrical molecule can be a key precursor which lead to the asymmetrically substituted GNR by the solution synthesis. As a result, we have developed the synthetic method via head-to-tale polymerization and cyclization by Pd-catalyzed and oxidative dehydrogenation (Figure 1). Based on the developed synthetic method with Z-shaped precursors, we have investigated the preparation of asymmetric GNR having different functional groups at opposite side of the edges. The relationship between the functionalization of edge structures and their properties will be discussed in the presentation.

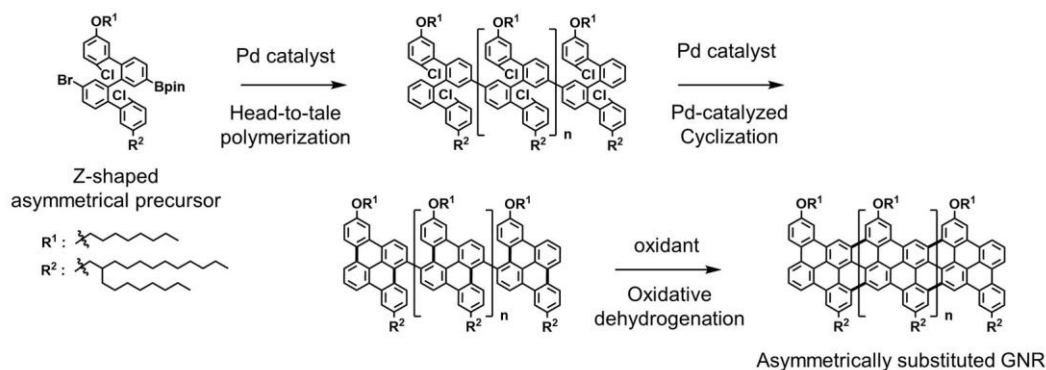


Figure 1 Synthetic scheme for asymmetrically substituted GNR from Z-shaped precursor

1) a) H. Sakaguchi, S. Song, T. Kojima, T. Nakae, *Nature Chem.* **2017**, 9, 57. b) T. Kojima, T. Nakae, Z. Xu, C. Saravanan, K. Watanabe, Y. Nakamura, H. Sakaguchi, *Chem. Asian J.* **2019**, 14, 4400.