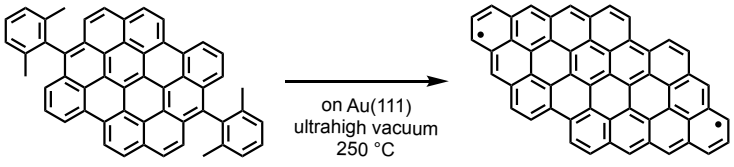
ナノグラフェンの精密合成と分子構造に依存した特異な物性

（沖縄科技大[1]・マックス・プランク高分子研[2]）○成田 明光[1,2]
Precision synthesis of nanographenes and their unique structure-dependent properties ([1]*Okinawa Institute of Science and Technology Graduate University*, [2]*Max Planck Institute for Polymer Research*) ○Akimitsu Narita[1,2]

"Nanographenes", corresponding to nanoscale structures of graphene, are expected as the next-generation carbon materials for their unique, structure-dependent electronic, optical, and magnetic properties. Large polycyclic aromatic hydrocarbons have attracted renewed attention as atomically precise, molecular nanographenes, which can be synthesized through the methods of synthetic organic chemistry.[1] We have synthesized dibenzo[*hi*,*st*]ovalene (DBOV) as an unprecedented nanographene with armchair and zigzag edges, which demonstrated remarkable fluorescence properties relevant for lasing and super-resolution bioimaging applications.[2,3] Moreover, π-extension of DBOV was achieved on a Au(111) surface under an ultrahigh vacuum (UHV) condition, leading to an open-shell nanographene with a large magnetic exchange coupling.[4] On the other hand, chiral nonplanar nanographenes can be obtained by introducing fjord edges, equivalent to the [5]helicene structure. We explored nanographenes having a combination of zigzag and fjord edges, achieving near infrared chiroptical properties.[5]
Keywords : Nanographene, Polycyclic Aromatic Hydrocarbons, On-Surface Synthesis, Helicene, Chirality

グラフェンのナノ構造に相当する「ナノグラフェン」は、その分子構造に依存して多彩な電子・光物性や磁性を示し、次世代炭素材料として期待されている[1)]。アームチェア型とジグザグ型のエッジ構造を併せ持つジベンゾ[*hi*,*st*]オバレン（DBOV）を新規ナノグラフェンとして合成したところ、レーザーや超解像バイオイメージングへの応用に繋がるような優れた蛍光特性が得られた[2,3)]。さらに、表面合成の手法により、超高真空下 Au(111)基板上での DBOV のπ拡張により、開殻性ナノグラフェンの合成にも成功している[4)]。また、[5]ヘリセン構造に相当するフィヨルド型とジグザグ型のエッジ構造を組み合わせた設計で、キラルな非平面ナノグラフェンを合成したところ、近赤外領域に至るキロプティカル特性が示された[5)]。



1) X.-Y. Wang, A. Narita, K. Müllen, *Nat. Rev. Chem.* **2017**, *2*, 0100.
2) G. M. Paternò, Q. Chen, M. A. Díaz-García, A. Narita, G. Lanzani, *et al*., *Mater. Horiz*., **2022**, *9*, 393.
3) X. Zhu, Q. Chen, H. Zhao, M. Bonn, A. Narita, X. Liu, *et al*., *J. Am. Chem. Soc*. **2024**, *146*, 5195.
4) K. Biswas, D. Soler, S. Mishra, Q. Chen, X. Yao, J. I. Urgel, A. Narita, R. Fasel, P. Jelínek, D. Écija, *et al*., *J. Am. Chem. Soc*. **2023**, *145*, 2968.
5) X. Xu, G. M. Paternò, A. Narita, *et al*., *Angew. Chem. Int. Ed.* **2023**, *62*, e202218350.