

# On-surface chemistry by high-resolution AFM

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## Background

- Inner structures of molecules resolved by atomic force microscopy
- Various nano-carbon structures synthesized by on-surface chemical reaction
- The state-of-the-art AFM became beneficial for the study of molecular electronics

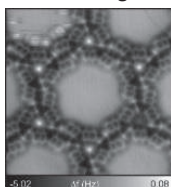
## Aim

- Synthesize and evaluation of functional nano-carbon structures
- High-resolution atomic force microscopy for on-surface molecular technology

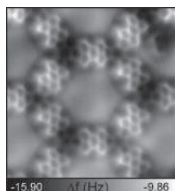
## Advanced Research Topics

### High-resolution imaging

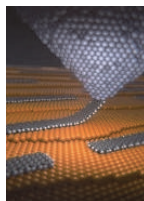
Halogen bonding



2D-MOF

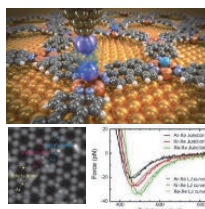


Superlubricity

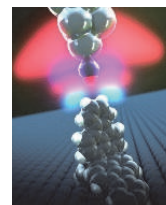


### High-resolution force measurement

Van der Waals force

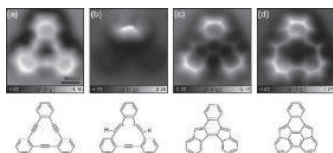


Intermolecular bond

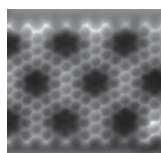


### On-surface reaction

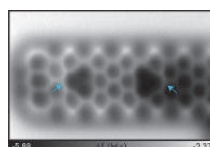
Sequential on-surface reaction



Graphene nanoribbons



Boron doped



Boron + Nitrogen doped

### High-resolution AFM/STM system



## Publications

- S. Kawai *et al.* *Science Adv.* **4**, eaar7181 (2018).
- S. Kawai *et al.* *Science Adv.* **3**, e1603258 (2017).
- S. Kawai *et al.* *Nature Commun.* **7**, 12711 (2016).
- S. Kawai *et al.* *Nature Commun.* **7**, 11559 (2016).
- I. Piquero-Zulaica *et al.* *Nature Commun.* **8**, 787 (2017).
- S. Kawai *et al.* *Science* **351**, 957 (2016).

## Summary

- Core technology to produce next-generation carbon devices
- Reliable tool for on-surface chemical reaction

## Research outcome

- Direct identification of molecular structures, synthesized by on-surface reaction
- Functionalization and mounting technology of nano-carbon structures