

## Electrochemical oxidation and reduction of graphite by continuous flow system

Yuta Nishina

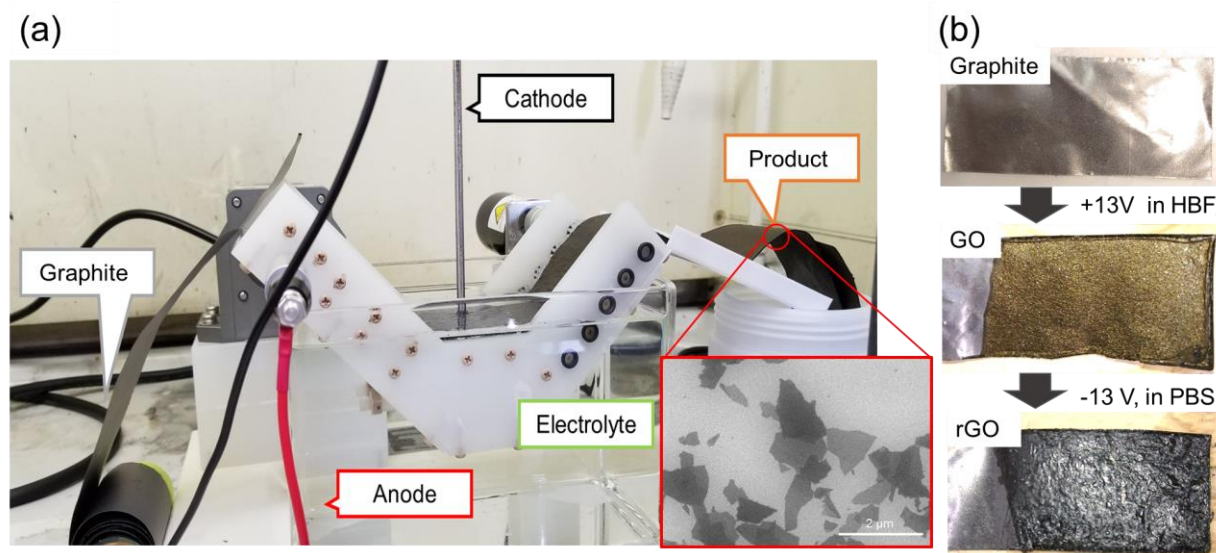
Okayama University, 3-1-1 Tsushimanaka, Okayama, Japan  
nisina-y@E-mail (Calibri 10)

Exfoliation of graphite through functionalization is a promising technique to produce two-dimensional (2D) nanocarbons on a large scale. Due to the high stability of graphite, a conventional functionalization of graphite has been performed in harsh conditions. Therefore, environmental and safety have been problems for scaling up the operation. In contrast, the electrochemical functionalization of a graphite electrode has recently attracted considerable attention because it does not require oxidants or acid. However, 2D carbons produced through the existing electrochemical method are generally lacking in quality, due to the non-uniform destruction of the intermediately functionalized graphite. We discovered a method for the non-destructive functionalization of graphite using  $\text{HBF}_4$  as an electrolyte. This electrochemical method is also applicable to a continuous flow system, thus promising the mass production of 2D carbons for future industrialization. Further, successive electrochemical oxidation and reduction was achieved. Thus, the method provides facile access to high-quality two-dimensional carbon materials in a manner that has the potential for mass production.

### References

- [1] B. D. L. Campéon, M. Akada, M. S. Ahmad, Y. Nishikawa, K. Gotoh, Y. Nishina, *Carbon* 158 (2020), 356.
- [2] M. Komoda, Y. Nishina, *Electrochem. Acta* 430 (2022) 141087.

### Figures



**Figure 1:** (a) Continuous-flow electrochemical oxidation system. Inset is SEM image of the product. (b) Successive electrochemical oxidation and reduction of graphite sheet.