

New bubble-exfoliation route to prepare high-quality graphene with high yield

With the support by the National Natural Science Foundation of China and the Ministry of Science and Technology of China, the research team led by Prof. Ding Guqiao (丁古巧) and Dr. He Peng (何朋) at Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, achieved a milestone on the facile and scalable preparation of high-quality graphene, which was published in *Chemistry of Materials* (2017, 29: 8578–8582).

Chemical bubble exfoliation of intercalated graphite is one of the promising strategies for massive production of high-quality graphene. Conventional methods, separating intercalation and bubble exfoliation into two steps in different pots, have demonstrated desirable efficiency by previous reports, but suffer harsh intercalation conditions or/and tedious procedures. Previous attempts to address this issue through integration of intercalation and exfoliation processes in one pot can only produce very thick graphene platelets (29–100 layers). Therefore, scalable preparation of high-quality graphene with high efficiency remains a big challenge.

To solve this problem, their group developed a two-step and one-pot method to facilitate the fabrication of high-quality graphene with very high yield. For the first time, the feasibility of kinetically intensified bubble exfoliation of graphite to prepare graphene in one pot is realized. Graphene (≤ 10 atomic layers) of large size (average sheet area of $54.7 \mu\text{m}^2$) and high quality (average hole mobility up to $554.8 \text{ cm}^2 \text{ v}^{-1} \text{ s}^{-1}$) accounts for up to 90.8% of the product without extra screening process, exhibiting evident advantages over conventional bubble-exfoliation methods. Detailed mechanism analyses highlight the significance of the two-step strategy through simple temperature manipulation. Both pre-intercalation (first step) and subsequent intensified bubble generation (second step) are critical for efficient exfoliation of graphite in one pot.

Independent of very high temperature intercalation, toxic intercalant and dangerous exfoliation-promoting agent, this method would greatly benefit the scalable fabrication of high-quality graphene. In the future, more investigations are needed to better control the lateral size, the thickness, the defects and the yield of graphene. Furthermore, it may be utilized for controllable fabrication of other 2D materials.

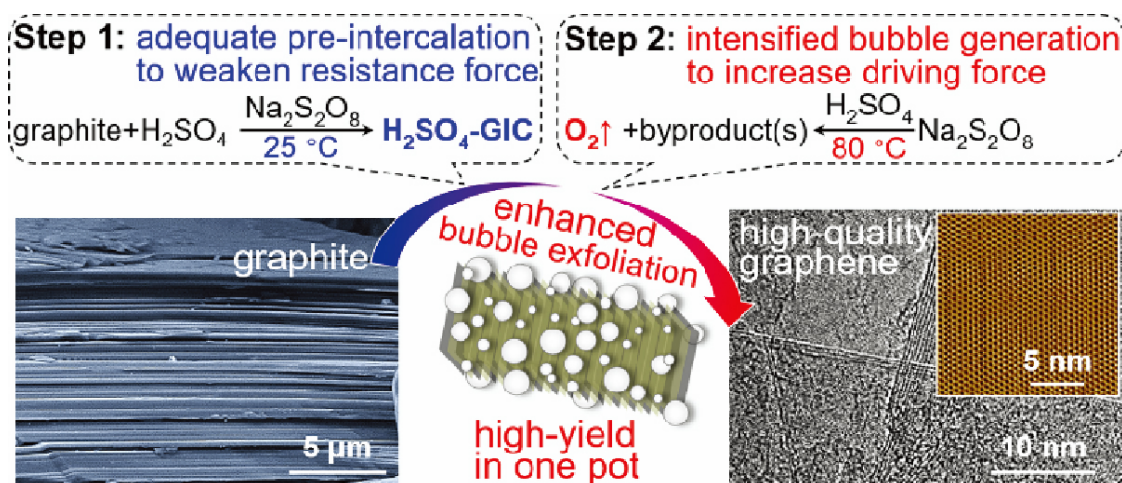


Figure Bubble-exfoliation route to prepare high-quality graphene from graphite