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SYNTHESIS OF GRAPHENE IN MICROWAVE PLASMA TORCH

Plasma synthesis of graphene nanosheets by decomposition of ethanol vapours in dual-channel argon microwave plasma torch at atmospheric pressure

It is now 15 years since the rediscovery of a material holding great promise for various applications, including wearable electronics, energy storage, composite materials and many more [1]. Single-atom thick layer was extracted from bulk graphite with a scotch tape technique creating graphene. Synthesis of graphene in plasma is employing bottom-up approach to create it from its building blocks: atoms and molecules of carbon.

Photography of the plasma synthesis of graphene is shown in Fig. 1. Discharge is ignited in argon and ethanol vapours are used as a source of carbon. They require a lot of energy for decomposition. Secondary annular channel is used to avoid extinguishing the plasma. Atoms and molecules release excess energy in form of light. Each one of them has its own color fingerprint. There is observable pinkish glow corresponding to argon at the start. After that, ethanol vapours are mixed into the plasma, they decompose, and we can observe green emission of diatomic carbon molecule. Decomposed molecules escape plasma forming small flakes of graphene called nanosheets and other different products like radicals. Orange glow corresponds to thermal emission due to exothermic reactions and small orange lines are graphene clusters recirculating in the chamber. The final products are collected on a silicon substrate or on a filter [2].

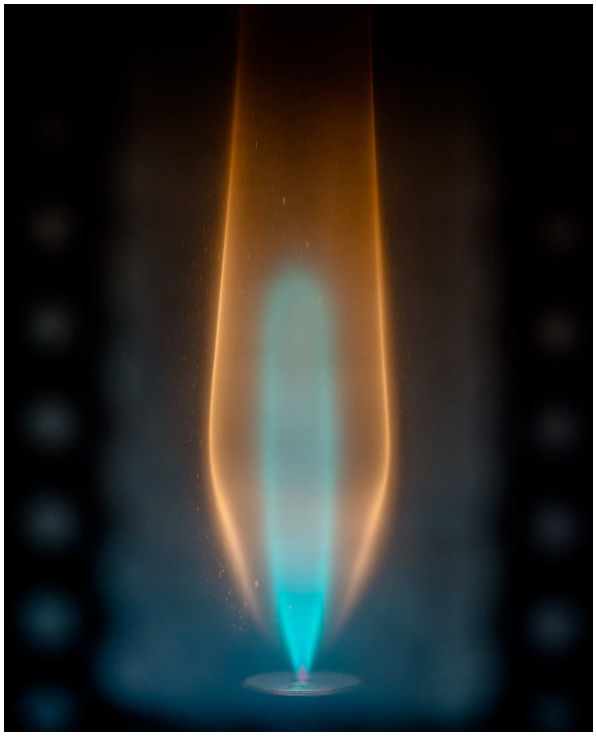

Fig. 1. Plasma flame during graphene synthesis.

REFERENCES

[1] Huang X. et al., *Small*; 2011, 7.14, 1876-1902.
[2] Toman J. et al., *Journal of Physics D; Applied Physics,* 2019, 52(26), 265205.

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