Keep-in-Touch meeting
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Production of Graphene, Graphene Derivatives and other carbon-based hybrid structures using atmospheric surface-wave plasmas

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The wide adoption of graphene and derivatives has been hindered by the low quality of commercially available products sold as such. Furthermore, the development of new consistent and repeatable methods for the synthesis of large quantities of high quality customizable carbon-based nanostructures remains a major challenge.

In this KIT meeting, a disruptive plasma technology and a corresponding laboratory prototype of a versatile microwave plasma-based machine for gram-scale fabrication of high-quality graphene and derivatives (N-graphene, Graphene/N-graphene-metal oxides) are presented. The machine enables the conversion of cheap carbon-based precursors (ethanol, CH_4, CO_2, biomass slurry, etc.) into high-valued, high-quality graphene derivatives with tailored properties. Different structures (e.g.: graphene sheets, N-graphene, hybrid nanomaterials) can be fabricated using the same device, by applying the corresponding synthesis protocols. Controllable, continuous fabrication of graphene/N-graphene at a gram scale ensuring high-level single layer selectivity (~50 %), high production rate (~40 mg/min) and repeatability has been achieved using ethanol, methane or acetonitrile as starting materials. The fabricated graphene/N-graphene sheets possess high quality as evidenced by comprehensive physicochemical analyses made (for pure graphene C/O ratio: > 50; sp^2% ~ 70%; for N-graphene C/O ratio: > 40; sp^2% >60%).

We will also address potential applications for the synthesized structures, along with some of the most recent results in different domains.

Acknowledgments