# Plasma diagnostics during microwave plasma synthesis of graphene nanosheets

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Graphene nanosheets possess many extraordinary properties with promising applications, e.g. in energy storage. However, suitable technique for cost effective synthesis is needed. Microwave plasma is one of the considered techniques but requires further diagnostics of the influence of different parameters to control the synthesis and to yield a high quality graphene [1].

Graphene nanosheets were synthesized by decomposition of precursor (ethanol) vapours in argon microwave plasma excited by surface wave launcher (surfaguide [2]) at 2.45 GHz. The synthesis process took place in the volume, i.e. no substrate or catalyst was needed and the product was in a flake form. Their quality could be controlled by the flow of carrier gas, the amount of precursor and the input microwave power. We performed the synthesis in both low pressure and atmospheric pressure regimes. Different argon flows were tested in the range 0.2-3 L/min with various ethanol percentages. The main plasma parameters were studied by optical emission spectroscopy and microwave interferometry. Spatial evolution of the gas temperature was calculated from the emission spectra, too. The synthesized graphene sheets were analyzed by Raman spectroscopy and scanning electron microscopy.

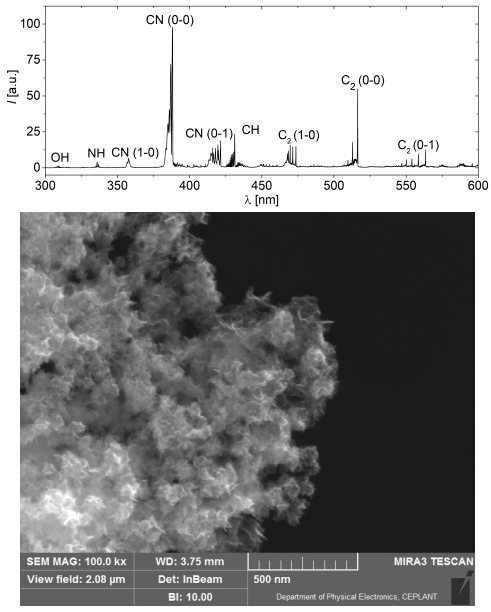


Figure 1: *Emission spectra of Ar plasma with ethanol admixture (top) and SEM image of graphene flake. Experimental conditions: 350 W argon 280 sccm, pressure 500 Pa, partial pressure of ethanol vapours 66 Pa.*

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## References

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