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Production of Graphene in 'Green' Solvent

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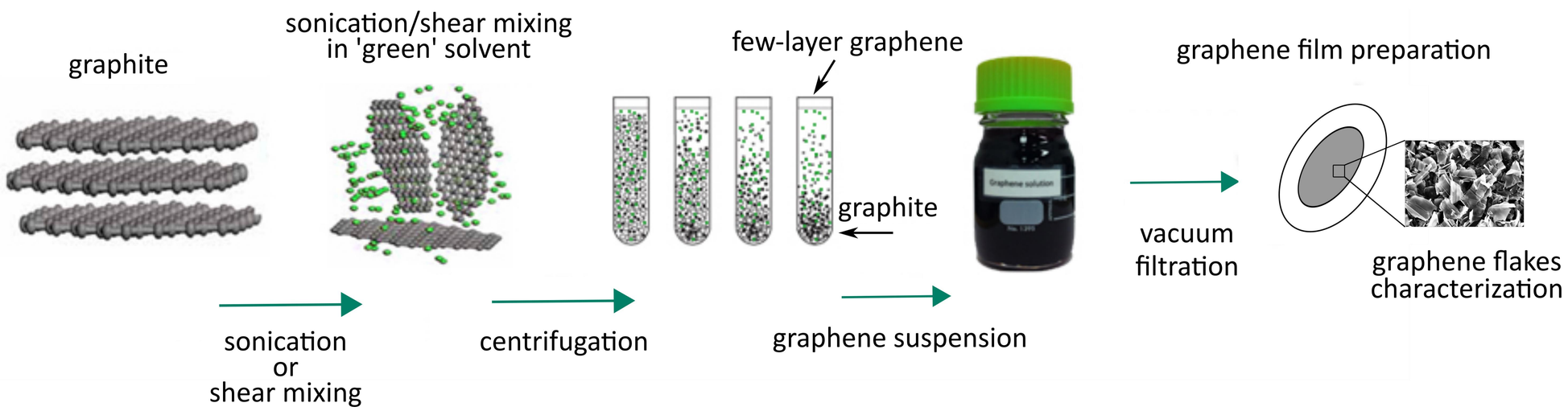
Mass production of graphene is crucial for its wide application in conductive inks, composite materials, supercapacitors, fuel cells, batteries, etc. Here we present the effective and scalable method to produce good quality few-layer graphene flakes with using liquid-phase exfoliation of graphite in 'green' solvent. Until now, the most commonly used solvent in the liquid exfoliation method was N-methyl-2-pyrrolidone (NMP)[1]. A relatively expensive and toxic solvent, which requires efficient cooling during the exfoliation process. We show that the replacement of NMP could be effective using a 'green' organic solvent, e. g. castor oil[2], cheaper and more safe for human and environment. The details of the exfoliation process are discussed.

Intruduction

Mass production of graphene is crucial for its wide application in conductive inks, composite materials, supercapacitors, fuel cells, batteries, etc. Here we present the effective and scalable method to produce good quality few-layer graphene flakes with using liquid-phase exfoliation of graphite in 'green' solvent. Until now, the most commonly used solvent in the liquid exfoliation method was N-methyl-2-pyrrolidone (NMP)[1]. A relatively expensive and toxic solvent, which requires efficient cooling during the exfoliation process. We show that the replacement of NMP could be effective using a 'green' organic solvent, e. g. castor oil[2], cheaper and more safe for human and environment. The details of the exfoliation process are discussed.

Graphene flakes production[3]



Process parameters:

- **Solvent – castor oil**
- **Temperature of sonication/shear mixing process ≥ 45°C**

Graphene flakes characterization

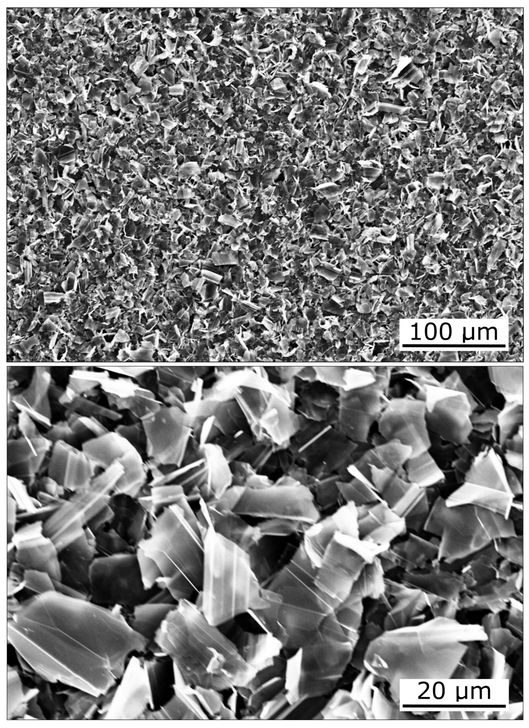


Fig. 2. SEM images of a film of grafen flakes obtained by vacuum filtration from a suspension manufactures according to the invension.

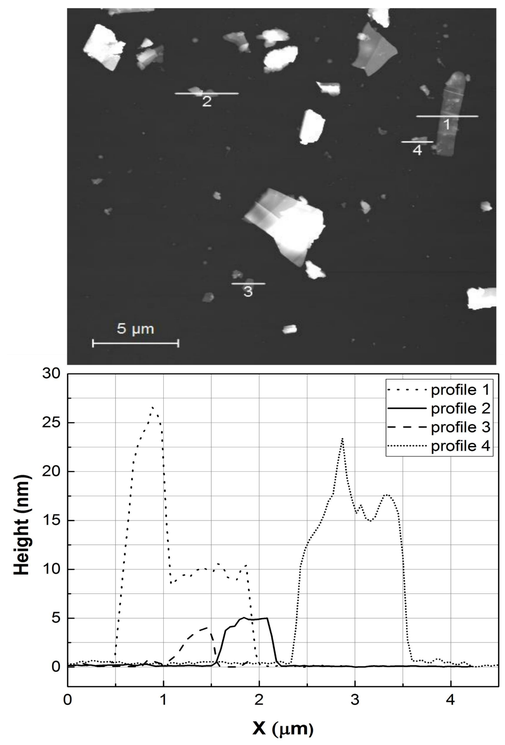


Fig. 3. AFM image of graphene flakes obtained according to the invension, on a SiO_2/Si substrate.

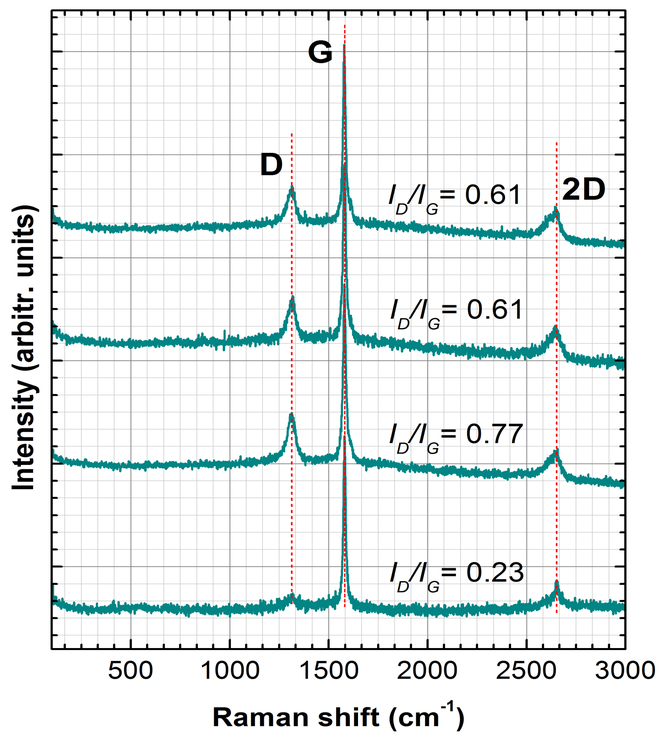


Fig. 4. Raman spectra of a film of graphene flakes obtained by vacuum filtration from a suspension manufactures according to the invension.

Conclusions

We have shown the effective and scalable method to produce few-layer graphene flakes with using liquid-phase exfoliation of graphite in castor oil. This method allows to obtain the graphene flakes with:

- good quality - the studies of prepared samples indicate a negligible presence of defects in the structure of graphene layers,
- thikness from a few to several dozen atomic layers,
- surface from few to hundreds µm^2.

The method can influence wider implementations of graphene in industrial solutions.

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