Optical properties of graphene sheets from various origin

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Graphene is a monolayer material with hexagonal crystalline structure made of carbon atoms. It has been gaining a lot of attention throughout recent years, because of its unique mechanical and electrical properties. The effectiveness of graphene based devices could be increased significantly [1], therefore it is thought to be capable of being used in electronic devices instead of silicon. There are various ways of manufacturing graphene sheets. One of them is mechanical exfoliation technique [2] from natural bulk graphite. It's the most common fabrication method of large quantities of a single layer graphene. Other techniques focus on obtaining graphene synthetically, for instance using the chemical vapor deposition (CVD) method [3] or molecular beam epitaxy (MBE) [4]. The properties of samples fabricated in different way may vary significantly. In our research we focused on how the disorder band in graphene (the D band) alter depending on the material used or a specific manufacturing method applied. Control over disorder may be particularly useful as it can possibly make the opening of the energy bandgap in graphene [5].

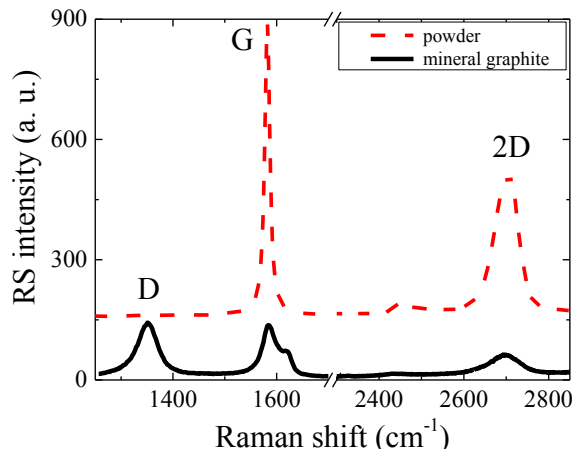

Figure 1. Comparison of Raman spectra obtained from mineral and powder graphite.

In this communication, we present our research on the disorder band in graphene sheets of various origin. The samples were thinned down by mechanical exfoliation with a high-quality backgrinding tape and transferred onto a Si/SiO_2 substrates. First sample was extracted from natural graphite powder and the second one from mineral graphite. The properties of samples prepared in by that method were next studied by micro-Raman spectroscopy using a continuous wave 532 nm Nd: YAG laser.

The studies showed that despite both materials being natural, obtained results were completely different. The spectrum of the exfoliated graphite ore exhibited a D band as high as the G peak, which can lead to a conclusion that this crystal has many defects in its structure. On the other hand, the graphite powder spectrum didn't show any D band at all. In further studies we would like to extend our research to synthetic graphene samples fabricated using the CVD method as well as samples grown from liquid metal.

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