Laser processing of carbides: Growth of graphene-like structures

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ABSTRACT

After fifteen years of intense fundamental research on graphene research, it is now accepted that graphene's superior physical properties are currently well understood. Major experimental challenges are now related to the large-scale production of high-quality graphene, which is the prerequisite to evolve fundamental graphene science into technological applications. One of the most promising methods for large area, high quality graphene production is the thermal decomposition of SiC, which leads to the growth of epitaxial graphene.

The full potential of laser-assisted methods in graphene productions has not yet been unlocked, despite that these methods offer a number of advantages as they are fast, low-cost, environmentally friendly and adaptable to current technological platforms. Few investigations have appeared so far aimed at producing graphene using laser beams. Lasers have been employed towards two main directions, i.e. graphene growth/production and processing of graphene oxide towards obtaining reduced graphene oxide. Laser wavelengths ranging from ultraviolet to infrared have been used both in the cw and pulsed modes. In their vast majority, studies of laser-assisted methods result in graphene of dubious quality.

Based on our previous work on the controlled decomposition of SiC [1], here we show that decomposition of various carbides such as, TiC, ZrC, NbC, VC, W2C and Mo2C, using laser sources in the near- and mid-infrared results under certain cases good quality graphene-like structures. A number of laser parameters (e.g. laser power, irradiation time and the laser pulse frequency) is optimized to yield decomposition with the best graphene quality. The decomposed products are characterized by Raman spectroscopy and SEM.

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REFERENCES

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