Low Cost Plasma Synthesis of Graphene Nanoplatelets from Methane

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Abstract

A DC thermal plasma reactor system designed for the synthesis of inorganic nanoparticles was utilized to investigate the applicability of this system for the bottom-up synthesis of graphene nanoplatelets. A systematic investigation of organic molecule precursors was performed. Most precursor materials tried gave carbon nanoparticles with spheroidal morphology and varying degrees of graphitization. Aromatic and poly-aromatic precursors gave high carbon yields but did not give graphene nanoplatelets. However, molecules predominantly generating 2-carbon fragments on pyrolysis did give graphene nanoplatelets, with higher quality resulting from saturated 2-carbon fragments. Methane, which generates 2-carbon fragments on pyrolysis, gave the highest quality pristine graphene nanoplatelets at substantial yield and high purity. The low cost and natural abundance of methane should enable this process to yield high performance graphene nanoplatelets in bulk at a very competitive cost when commercialized. Characterization, properties and performance of this material in applications will also be described.

References

[1] David B. Asay, Tien-Chieh Chao, Umesh C. Desai, Cheng-Hung Hung, Masayuki Nakajima and Noel Vanier, United States Patent Application, **2012**/0211160 A1.

Figures

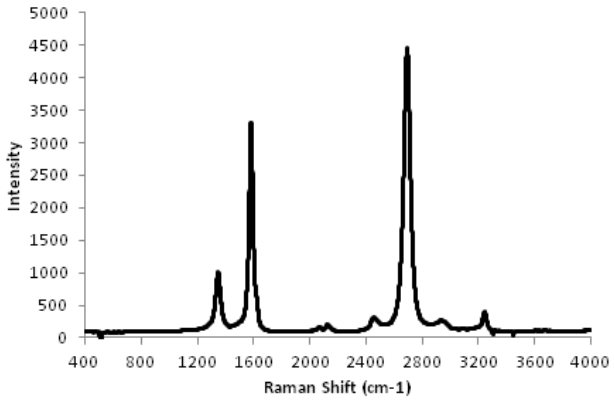

Figure 1: The Raman spectrum of graphene nanoplatelets from methane feed material

Figure 2: The TEM of graphene nanoplatelets from methane feed material