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Shock processing of carbon nanopowder

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Owing to the importance of complex molecules in the Interstellar Medium (ISM), many experiments have been carried out to understand their synthesis in interstellar conditions. Amongst the complex molecules identified Polyaromatic hydrocarbons (PAH) and structured carbon, such as C_{60}/C_{70}, have attracted alot of interest due to their characteristic absorption/emission in the infrared which is believed to explain many of the infrared bands in the ISM [1]. In addition to the PAHs, Mixed Aromatic / Aliphatic Nanoparticles (MAONs) are also proposed to contribute to the spectral signatures that are observed in the ISM [2].

The synthesis of such complex molecules is either via the energetic processing of simple hydrocarbon molecules, a simple bottom-top model, or via a complex route where PAH molecules are synthesized on a graphitized silicon carbide surface, a top-bottom chemical pathway [3]. In the top-bottom model, energetic processing of graphene has been shown to synthesize fullerene (C_{60}) [4] whilst UV processing of arophatic molecules has been shown to synthesize C_{60} [5]. Another route is irradiation of the icy mantles of interstellar dust for example simple hydrocarbons such as methane subjected to irradiation in a Neon matrix have been observed to synthesize carbon clusters up to C_{20} [6].

Therefore, there is clearly a demand for more experiments to understand the end products resulting from carbon as the starting material. We employed the high intensity shock tube in PRL to shock the pure (<100 nm) carbon powder to temperatures as high as 8000 K for about 2 ms. The resulting sample after shock processing was analysed using Raman, IR spectroscopy and Imaging (FE-SEM / HR-TEM) techniques. Here we present the first results from the preliminary experiments carried out by shock processing carbon nanopowder.

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