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低温でグラス基板上に直接グラフェン膜の成長

Direct Synthesis of Graphene thin films on Glass Substrates at low Temperature

o アディカリ　スディープ、内田　秀雄、脇田　紘一、梅野　正義

Chubu Univ., °Sudip Adhikari, Hideo Uchida, Keichi Wakita, Masayoshi Umeno

Email: sudip@isc.chubu.ac.jp

Since the discovery of mono and few layers of graphene in a substract in 2004, it has become the attractive research subject in nanomaterial science due to its unique properties such as electrical, mechanical, thermal conductive and a possible use of transparent electrodes, etc. [1]. For the propose of all above applications, researchers are synthesis graphene by various method, like thermal chemical vapour deposition (CVD), micromechanical cleavage or chemical exfoliation of graphite, thermal decomposition of SiC [2,3]. In this work we synthesized graphene on glass substrate directly (without using catalyst) by microwave surface wave plasma CVD using hydrocarbon as a source gas.

Graphene film was synthesized by microwave (MW) surface wave plasma (SWP) chemical vapor deposition (CVD) on quartz substrate. The detail of MW SWP CVD is described elsewhere [4]. Argon (Ar) and acetylene (C_2H_2) were used as a carrier and source gases for plasma source. The detail substrate cleaning process is described elsewhere [4]. The CVD chamber was evacuated to a base pressure at approximately 5×10^{-4} Pa using a turbo pumps. The launched microwave power was typically 1500 W and a constant gas composition pressure is maintained at 20 Pa and substrate temperature was set at 150°C. The synthesized graphene were characterized, by UV/VIS/NIR spectrophotometer, transmission electron microscope (TEM) and Raman spectroscopy.

Fig. 1 shows the Raman spectrum of grapheme film deposited on glass substrate. Three peaks centered at 1327, 1559, 2645 cm^{-1} which is assigned to the D (disorderd mode), G (graphite mode) and 2D (D mode overtone) modes of graphene respectively. It is reported that the D-peak represents disordered sp^2-hybridized carbon with an amount of sp^3-hybrodized carbon, while the G-peaks represents graphite-like sp^2-hybridized carbon in the deposited film [5]. The presence of 2D peak shows a good agreement of graphene structure formation into the film. The Raman spectrum of carbon material is quite remarkable in order to study the quality of graphene structure [6]. We found 50.28 kΩ/sq sheet resistance and 55% (550 nm) transmittance of graphene film deposited on glass substrate shown in fig. 2.

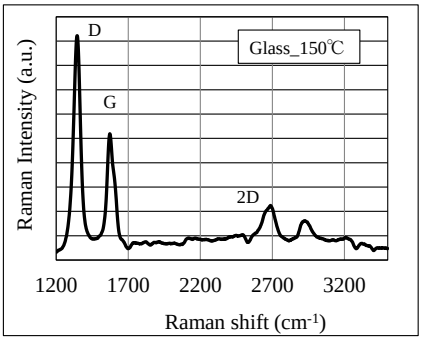

Fig. 1 Raman spectrum of graphene film grown on glass substrate.

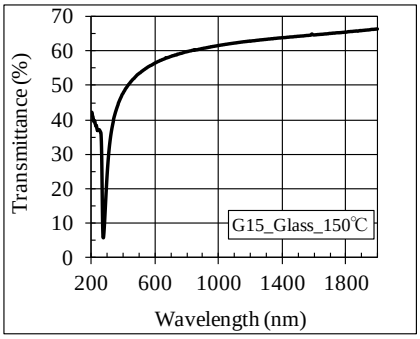

Fig. 2. Transmittance spectrum of grapheme film grown on glass substrate.

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