Process optimization of Joule heating CVD of graphene on meter-scale copper foil

Sejeong Won[1]
Hyun-June Jung[1,2], Yehrin Jo[1], Min-Ah Yoon[1], Kyung-Shik Kim[3], Kichul Kim[1], Hak-Joo Lee[1], Jae-Hyun Kim[3*]

[1]*Center for Advanced Meta-Materials (CAMM), Daejeon 34103, Republic of Korea*
[2]*Flyer Co., Ltd., Daejeon 34141, Republic of Korea*
[3]*Department of Nanomechanics, Korea Institute of Machinery and Materials (KIMM), Daejeon 34103, Republic of Korea*
sjw@kimm.re.kr

Abstract

Chemical vapor deposition (CVD) is currently the most promising method for producing large-area, high-quality graphene films [1]. Roll-to-roll CVD synthesis has been attempted to minimize the time in heating and cooling the CVD chamber [2-4]. A Joule heating-based synthesis method that uses high current flows through a copper foil and resistively heats the foil up to a prescribed temperature, has the advantage of low power consumption and small thermal mass [4]. However, this method has not been extensively researched due to difficulties in achieving uniform temperature distribution across the copper foil. To address this issue, we propose a U-shaped copper foil configuration that enhances temperature uniformity. The experimental design method was used to establish the optimal graphene synthesis conditions, and graphene was continuously synthesized while transporting a 2-meter-long copper foil. Electron microscopy and sheet resistance measurement confirmed the high-quality of the synthesized graphene.

References

[1] X. Li *et al.,* Science, 5932 (2009) 1312−1314
[2] T. Hesjedal, Appl. Phys. Lett., 13 (2011)133106
[3] T. Yamada *et al.,* Carbon, 7(2012) 2615−2619
[4] T. Kobayashi, *et al.,* Appl. Phys. Lett., 2 (2013) 023112

Figures

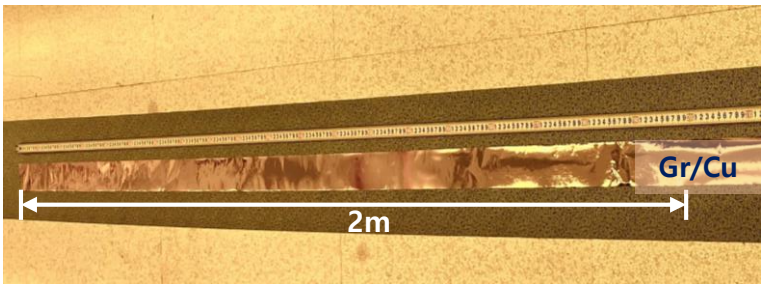

Figure 1: Schematic of Joule heating-based roll-to-roll graphene synthesis equipment

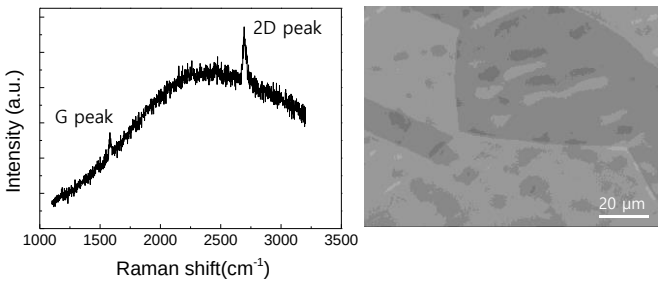

Figure 2: Raman spectra and SEM image of graphene/Cu foil