# Deposition of graphene on flexible web using roll-to-roll microwave plasma CVD

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Flexible transparent conductive films are important parts for next-generation opto-electronic applications. Graphene is one of the appropriate materials for flexible transparent films, since an ideal mono-layer graphene has transmittance of 97.7 % and electron mobility of 200,000 $cm^2/Vs$ at room temperature. These superior properties of graphene are obtained from mechanically exfoliated pieces. Therefore, graphene films in larger size are desired for practical applications.

In order to obtain large size of graphene, thermal CVD on Cu surface was reported. The obtained thermal CVD graphene films show sheet resistance of 30Ω/sq. and optical transparent of 91 % [1]. Touch panels, organic light emitting devices (OLED) and flexible electrical devices are fabricated using the thermal CVD grapheme. From mass production of point of view, both temperatures over 800ºC, which lead to wrinkles and strain in grapheme films, and periods of few ten minutes to form single layer graphene are remaining problems. Transfer processes need long periods to etch Cu foil, which is also one of the problems to be solved.

In our previous studies [2, 3], graphene depositions by roll-to-roll microwave plasma CVD at low temperatures of about 300ºC have been reported. We obtained 600 mm in width and 200 m in length using our system. However, it is necessary to reduce the wrinkles due to roll-to-roll process (not thermal effects).

Depositions of graphene films on various webs are advantages of the low temperature roll-to-roll plasma CVD processes. In this paper, Cu thin film/polyimide (Cu/PI), which is the flexible web, was used as the web for roll-to-roll graphene deposition in order to reduce wrinkles. It is confirmed that the use of Cu/PI suppresses the formation of wrinkles during the roll-to-roll deposition process. We also propose combination of the peeling of Cu from PI and the Cu thin film etching to reduce the periods of transfer process. Decrease of the sheet resistance in fabricated graphene transparent conductive film is confirmed.

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**References**

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