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In-situ detection of nano-crack of graphene using polarized optical microscopy

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Recent works for producing large-area, high quality graphene films through chemical vapor deposition (CVD) and transferring them onto various large-area substrates have offered the possibility of their use as transparent conductive films in various optoelectronic devices. However, various kinds of defects such as pinhole, nano-crack and grain boundaries incorporated for CVD growth process or transfer process of graphene to target substrates degrade the electrical and mechanical performance, which limit the quality needed for the practical use of graphene films. In particular, knowledge of the mechanism of defect generation in graphene under high strain is important to apply graphene in flexible and stretchable electronic devices. Therefore, various methods have been studied to understand the mechanism of defect generation and observe such defects directly. For example, microscopic tools such as TEM, AFM and STM have a way to observe grain boundaries and defects of graphene. However, these methods have drawbacks such as requirement of a complicated sample preparation, a time delay and limited size of observation. In this talk, we present in situ visualization method to identify the distribution of defects in graphene such as pinhole and crack created by growth and transfer process. In addition, we suggest the alignment of liquid crystal molecules on graphene shows strong correlation with domain size of graphene.