세미나 요약 (Abstract)

강연제목 (Title)	Freestanding Nanomembranes from Materials Innovation to AI hardware		
강연자 (Speaker Name)	배상훈	일시 (Date)	2021.12.27. 14:00~

The conventional electronic system has been developed upon Si-based thin-films because of their exceptional cost-effectiveness and mature processing systems. However, there are fundamental limitations in using conventional systems for future electronics such as wearable devices, biomedical devices, and edge computing devices. One of these most prevalent limitations is that current thin-film electronic systems have been developed on rigid wafers, which causes serious physical constrains because of the thick nature of the materials on the rigid wafers. Thus, an alternative approach has been required to secure mechanically low stiffness of materials and devices.

In this talk, I will discuss about our recent effort to tackle the aforementioned challenge by developing freestanding nanomembranes. First of all, we have conceived an idea to grow single crystalline materials on graphene-coated substrates. As graphene has information transparency, crystallographic information can penetrate through graphene as long as substrate's materials have polarity. Also, the slippery nature of graphene enables producing freestanding nanomembranes by exfoliating the grown single crystalline materials from the graphene coated substrates. With such freestanding nanomembranes, we have developed heterogeneously integrated in-sensor artificial intelligence (AI) computing devices. Second, we have developed mechanics to produce large-scale 2D materials by playing interfacial toughness contrast. As this approach allows producing various 2D materials at large-scale, various applications can be demonstrated at practical level. With such method, we recently succeeded, for the first time, in producing wide-bandgap 2D materials at practical level, showing a record photoluminescence quantum yield (PLQY). Also, we have designed a stackable AI hardware using 2D materials' outstanding mechanical property.

Reference

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[4] S. Bae et al, "Unveiling the carrier transport mechanism in epitaxial graphene for forming wafer-scale, single-domain graphene" ***PNAS***, 114 (16), 4082-4086, (2017)