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Title of the Presentation: Graphene sandwich structures for organic reactions

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Short Biography:

Seong In Yoon received his Ph.D. degree in energy engineering in Ulsan National Institute of Science and Technology (UNIST) in 2020, and he is now a postdoctoral researcher in the energy engineering of UNIST, Korea. He is currently studying on membrane application of two-dimensional (2D) materials such as confined 2D materials nanoreactor and 2D materials for proton exchange membrane.

Abstract:

For a long time, confinement effect in the confined space has drawn keen attention for tuning chemical reactivity.[1] Compared with 0D (zero-dimensional) and 1D confined spaces, 2D confined space is simple and structurally well-defined because direction of confinement effect only works up and down.[2] A graphene sandwich structure for liquid pockets, which is well-known 2D confined space, is used as 2D confined spaces, and phase transition[3] and hydrolysis[4] in graphene liquid pockets occurred due to high van der Waals pressure. However, until now, organic reaction in 2D confined space has not been reported nor compared with the reaction at bulk space. Herein, we demonstrated cyclodehydrogenation of hexaphenylbenzene, which is well-known strategy for syntheses of polycyclic aromatic hydrocarbons, in 2D materials confined space. In addition, polymerization of dopamine for sheet-like polycrystalline structure in 2D materials confined spaces were confirmed. Although these reactions do not occur in bulk solution or powder, nanoconfinement effect by high pressure in 2D confined vessels enable these reactions at the same conditions. Furthermore, graphene/polydopamine/graphene showed enhanced electrical and mechanical properties and excellent water-diffusion barrier roles compared to bilayer graphene.

[1] A-B. Grommet et al., *Nat. Nanotechnol.* **15**, 256-271 (2020).
[2] H. Li et al., *Proc. Natl. Acad. Sci. USA*, **111**, 17023-17028 (2017)
[3] T. Lehnert et al., *ACS Nano* **11,** 7967-7973 (2017).
[4] K. S. Vasu et al., *Nat. Commun.* **7,** 12168 (2016).