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2D crystal-based membranes for photocatalysis and separation

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The isolation of graphene has unveiled a wide range of novel 2-Dimensional (2D) materials with outstanding properties. Liquid-phase exfoliation (LPE) is a simple technique for production of 2D-crystal dispersions, which can be used to form coatings and membranes. 2D crystal-based membranes have already shown interesting properties, such as selective permeation of water, opening the possibility of using these membranes for gas or liquid separation. In this talk, we give two examples of 2D crystal-based membranes. The first membrane is obtained by LPE of graphitic carbon nitride (g-C_3N_4), which has been shown to be an efficient photo-catalyst for many reactions under visible light. Photo-degradation studies show that the membranes are very efficient in the degradation of several dyes. This is attributed to the membrane structure: As the catalyst is a porous laminate, the reactant can flow through the pores of the membrane and because the space between the g-C_3N_4 nanosheets is comparable to the size of the dyes, the probability of the reactants to be close to the catalyst is enhanced, making the reaction very efficient. The second type of 2D-crystal membrane is prepared by mixing LPE graphene with a polymer of intrinsic microporosity (PIM-1). Graphene is expected to improve membrane permeability, control over diffusion selectivity and to reduce the polymer ageing. Here we show characterization of those membranes by Raman spectroscopy and transmission electron microscopy and we show preliminary results on CO_2 permeability.

Biography

Yuyoung Shin has obtained her BSc in Chemistry from University of Sussex in 2010 and her MPhil in Chemistry from University of Cambridge in 2012, working with Dr Mark Miller on thermodynamics of charged nano-droplets. She has completed her PhD under the guidance of Prof. Cinzia Casiraghi at University of Manchester, working on synthesis and characterization of graphene-based membranes. During her studies, she contributed to a number of publications and recently had two publications on synthesis and characterization of graphene-based membranes.

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