Two-dimensional layered double hydroxide/graphene materials for water remediation

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With the growth of the industrial development, the need of new type of nanoparticles and techniques for waste water treatment remains a major concern for green environment. Layered double hydroxide (LDH) material such as $[LiAl_2(OH)_6]CO_3 \cdot 2H_2O$ (Li-Al LDH), consisting of positively charged layers, intercalated charge-balancing anions and water molecules (Fig. 1a,b), has been identified as a potential candidate for water remediation due to the ability to exchange anions in polluted water [1]. Moreover, the layers of LDH can be exfoliated into two-dimensional nanosheets to further enhance its properties (Fig.1c). In most previous studies, LDH is utilized in a powdery form which gives high surface area for anion exchange activity. However, after solution-based treatment, separating powdery LDH materials from the treated water is challenging and time consuming. Graphene oxide (GO), prepared by oxidation and exfoliation of graphite (Fig.1d,e), is an outstanding graphene derivative with a two-dimensional building block (Fig.1f) [2]. It has been demonstrated that GO has excellent ion selectivity toward various ions due to the presence of oxygen functionalities. These oxygen functionalities facilitate the interactions between a wide range of organic and inorganic ions. In this study, we combine GO and Li-Al LDH nanosheets for ion sieving. The successful exfoliation of individual GO and LDH sheets is presented. The structures of GO and LDH are characterized though various microscopies and spectroscopies. GO is found to be firmly in contact with the LDH nanosheets, and hence a uniform membrane is formed. We believe that GO/LDH hybrid membranes could offer a new perspective in diverse research fields and applications.

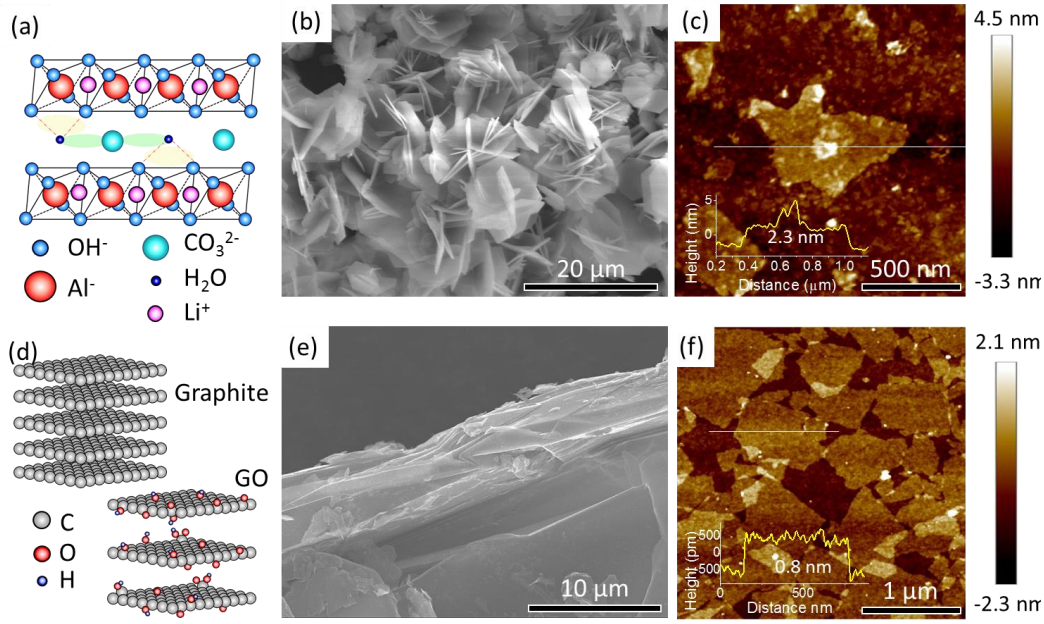

Figure 1 (a) Schematic of Li-Al LDH structure. The corresponding (b) scanning electron microscopic (SEM) image and (c) atomic force microscopic (AFM) image. (d) Schematics of the graphite and GO structures. The corresponding (e) SEM and (f) AFM images.

References:
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