Wolfson Department of Chemical Engineering Graduate Seminars

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The effect of faceting on the photocatalytic reduction of Cr^{+6} on BiOCl and on $BiYWO_6$.

Bismuth oxyhalides are considered to be promising photocatalysts for decomposition of pollutants into non-toxic molecules. These promising layered compounds have fascinating physicochemical properties and suitable band-structure, as well as high chemical and optical stability, nontoxicity, low cost, and corrosion resistance.

Recent years have shown that TiO_2 having high extent of exposed {001} facets, had higher photocatalytic efficiency than un-faceted TiO_2. To understand the effects of faceting in bismuth oxides two photocatalysts, BiOCl and $BiYWO_6$ (BYW), were chosen. While a few studies with BiOCl showed a faceting effect with this photocatalyst, there are no such studies with BYW.

In this research a set of well-defined and tailored BiOCl and BYW were prepared by using SDBS (Sodium dodecylbenzenesulfonate) as a capping agent. It has been found that the presence of SDBS affects the ratio between surface facets, as indicated by the SEM, XRD, as well as the surface area. Photocatalytic reduction of Cr^{+6} has shown a clear dependence on the ratio between the exposed facets of the photocatalyst, demonstrating the importance of developing new ways to control surface faceting, without reducing the specific surface area.

Shiran Shultz, PhD student

Supervisors: Associated Professor Viatcheslav Freger and Professor Raphael Semiat

Development of RO membranes with improved Boron rejection by in situ modification with hydrophobic molecules

Commercial polyamide RO membranes, though effective in terms of flux and salt removal, have a few drawbacks, in particular, poor rejection of boron (B) and thus are often unable to remove B to the required level in a one-pass sea desalination process. This complicates the process and available solutions increase the cost of desalinated water by 15-20%. Here we explore in-situ modification procedure that can significantly increase their boron rejection of polyamide RO membranes. Based on a hypothesis that increased hydrophobicity of the selective polyamide layer may help disrupt water-boric acid association and decouple water permeation from boron permeation, the proposed modification incorporates suitable modifying molecules, Such molecules have to combine a hydrophobic moiety and a reactive group that can chemically or physically bind to polyamide layer and thus tighten its structure and increase selectivity, a combination met by aliphatic amines. The results show that the proposed treatment with sufficiently long (up to 12 carbons) aliphatic amines may indeed reduce the boron passage by a factor of 2 to 4, without impairing the salt rejection of the membrane. The selectivity improvement comes at the expense of some flux reduction, but the flux-selectivity tradeoff improves compared to commercial polyamide membranes.

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Refreshments served at 13:15