**Photocatalytic Performances of Copper-based Photocatalysts with Well-defined Morphologies**

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Introduction.

The emergence of well-defined architectured photocatalysts has led to the realization of cuprous oxide (Cu2O) as a promising photocatalyst due to its earth abundancy, ease in synthesis and band potential suitability for photoredox reactions.1 Selecting photocatalysts with a suitable band structure and excellent stability is crucial to achieve an efficient photocatalytic system. In this regard, Cu2O that can be activated by visible light is considered as the best candidate due to its appropriate conduction and valance band potential. However, photocorrosion and rapid charge recombination are known to be the largest drawbacks of Cu2O.2 In this study, the photostability pathway of Cu2O is systematically studied to mitigate the photocorrosion problems. Meanwhile, facet-dependent properties were investigated to further understand the charge transfer and separation within Cu2O.

Results and Discussion.

Arising from its photostability issues, systematic investigations have suggested that self-photooxidation of Cu2O is the dominant photocorrosion pathway in a photocatalytic suspension system. Thus, the presence of hole scavenger was demonstrated to be vital in extracting holes from Cu2O and suppressing its oxidation into CuO.3 With a stable Cu2O photocatalyst, facet-dependent properties were revealed to play an important role in tuning the photocatalytic performance. Apart from the common facet-dependent properties (i.e. surface adsorption ability and surface electronic structures), the differences in surface defect density of each crystal facets also alter the photocatalytic performance of Cu2O. Lastly, Cu2O with well-defined morphologies were also shown to enable the synthesis of hollow CuxS via simple yet scalable ion-exchange method. By comparing the performances of hollow cubic and irregular CuxS samples, higher activity and stability of hollow cubic structure was clearly observed.4

Conclusion.

With proper morphological control of copper-based photocatalysts, photocatalytic performances can be enhanced. Apart from the understanding the photostability issues via systematic photocorrosion study, the effects of its facet-dependent properties towards photoreactivity were addressed. Further exploration of faceted-Cu2O also shown that it can be used as a template for the synthesis of other well-defined copper-based materials, in particular via simple ion-exchange method.

**References**

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