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Composition-dependent electrocatalytic properties of copper sulfides and their implication in quantum dot sensitized solar cells

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Quantum dot sensitized solar cells (QDSSCs) have emerged as one of the promising third-generation solar cells. While recent dramatic advances in QDSSCs, their performance still lags behind those of other next-generation solar cells, the reasons of which are partly attributed to the poor electrocatalytic activity of counter electrode. Corrosion by a polysulfide electrolyte in Pt has stimulated the development of metal sulfide-based electrocatalysts, among which copper sulfide stands out for its high electrocatalytic activity. Despite the wide-usage of copper sulfide for the counter electrode, the influence of its physical properties on the electrocatalytic activity remains elusive to date. Given various stoichiometries found in copper sulfides, which significantly affect their physical properties, it would be of great importance to elucidate the composition-dependent electrocatalytic properties. In this work, we synthesized copper sulfides with 4 different compositions - covellite (CuS), yarrowite ($Cu_{1.12}S$), anilite ($Cu_{1.75}S$), and digenite ($Cu_{1.8}S$) and studied the correlation between composition and electrocatalytic activity and stability. Our in-depth investigation revealed thatthe electrocatalytic activity and stability of covellite (CuS) were superior to those of other sulfide counterparts, which may be associated with the difference in crystal structure.

Biography

Chung Soo Kim has completed his BS at Hanyang University and currently he is an MS student at the Department of Bionanotechnology, Hanyang University, Republic of Korea.

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