Designing Stable $Cu(In,Ga)S_2$ based Photocathodes for Driving Photoelectrochemical Reactions

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Solar-driven photoelectrochemical (PEC) systems that convert water/CO_2 to produce sustainable fuels and chemicals, are far from their practical utilization due to instability and selectivity in aqueous environments. The talk will focus on bandgap and composition engineered $Cu(In,Ga)S_2$ photocathodes for photoelectrochemical water splitting and CO_2 reduction. The PEC CO_2R can be directly facilitated on bare CIGS surface producing hydrogen, CO and $HCOO^-$ at Faradaic efficiency (FE) of 54%, 32 % and 14 % respectively, without any transport layer or co-catalyst. The photoelectrochemical behavior and the operando studies will be presented to rationalize the origin of unique surface behavior and aqueous stability. Extensive structural investigations reveal the role of surface composition to be critical for stability and activity. Atomistic simulations combined with experimental insights help in understanding the surface activity and reaction mechanism.

This composition engineering approach makes CIGS favorable for PEC devices.

The findings are useful to design highly stable and active photocathodes for driving photoelectro-chemical reactions.

References:

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