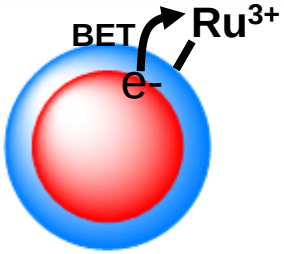
Electron Transfer Mechanisms Underpinning Core/Shell Photoanode Performance Depend on Trap State Availability

Scientific Achievement

Back electron transfer (BET) pathways in SnO_2/TiO_2 core/shell structures are found to proceed through competing thermally activated and tunneling mechanisms, dictated by number of traps.



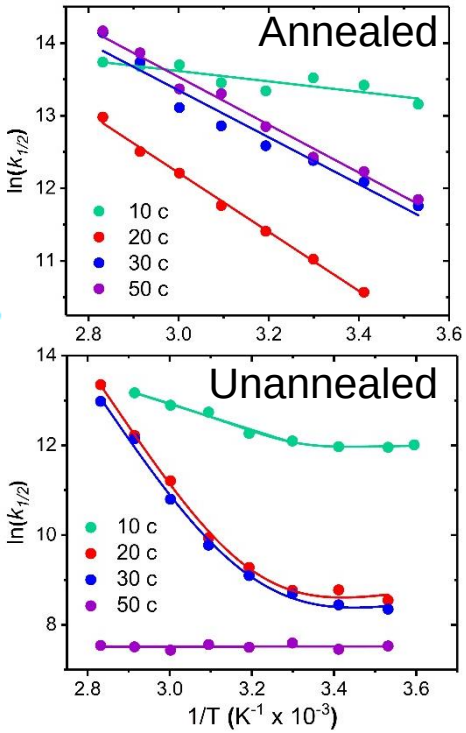
SnO_2 core
TiO_2 shell

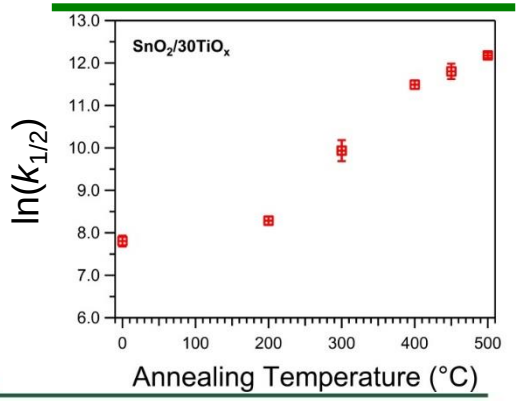
Significance and Impact

Core-shell structures like SnO_2/TiO_2 show excellent performance in photoanode applications, but the mechanism by which they do so is debated.

Research Details

- BET is thermally activated in annealed films (450 °C) and thin unannealed shells at high temperature. BET occurs through tunneling in unannealed shells at low temperature and at all temperatures when shells are thick (50 cycle).
- BET kinetics systematically increase with annealing temperature of the core/shell film.
- *A multiple trap-assisted tunneling mechanism is accessible in core/shell materials with more trap states.*





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Manuscript in Preparation

Work was performed at the University of North Carolina

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