We show that a significant improvement of the light to electric power conversion efficiency of quantum dot sensitized solar cells with a polysulfide electrolyte can be achieved when a PbS counter electrode is used. An acid pretreatment of a Pb metal foil followed by dipping into polysulfide solution provides a counter electrode which improves the short circuit current, open circuit voltage and fill factor compared to commonly used Pt electrodes. Electrochemical impedance spectroscopy reveals a low charge transfer resistance between polysulfide and PbS, indicating the high catalytic activity of PbS. Moreover, a comparison with reported charge transfer resistance values at open circuit potential for alternative counter electrodes for polysulfide shows that PbS is the most catalytic of all. For a CdSe quantum dot sensitized mesoporous TiO$_2$ electrode we achieved a conversion efficiency of 3% using PbS as a counter electrode.

Counter Electrode Preparation & Characterization

![Counter Electrode Preparation & Characterization](image)

Charge Transfer Resistance ($R_{ct}$) - Impedance Spectroscopy Measurement

![Charge Transfer Resistance ($R_{ct}$) - Impedance Spectroscopy Measurement](image)

New Results - Decreasing Recombination

![New Results - Decreasing Recombination](image)

HR-TEM

![HR-TEM](image)

Key Problems in QDSSC

![Key Problems in QDSSC](image)

Counter Electrode

![Counter Electrode](image)

(a) $i$–$V$ characteristics of a QDSSC based on Pt (solid line) and PbS (broken line) counter electrodes. (b) A summarized data of cells characteristics. The use of PbS as counter electrode results in high values in all parameters. (c) Incident photon to current conversion efficiencies (IPCEs) measured as a function of wavelength for QDSSC prepared using Pt and PbS counter electrodes.