

Predicted photoreflectance signatures on QD selective contacts for hot carrier solar cells



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Introduction

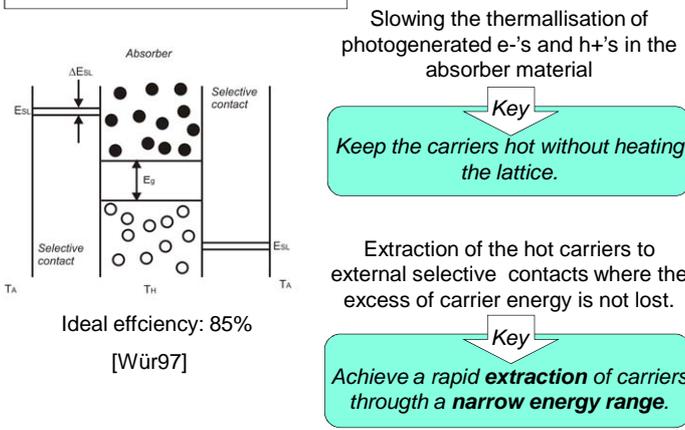
The CO₂ emission of our present energy transformation processes, based mainly on burning fossil fuels, is possibly the main cause of global climatic change.

The photovoltaic conversion of solar energy is a clean way of producing which for sustainability should (and most probably will) become a major source of electricity

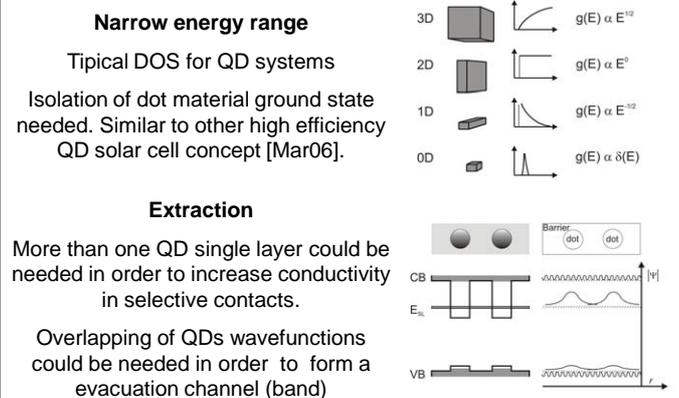
The sun is a huge resource but relatively diluted and it is reasonable to expect that only high efficiency extraction can be cost effective for mass exploitation [Luq08]. New concepts are necessary → such as hot carrier solar cells



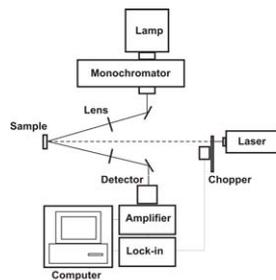
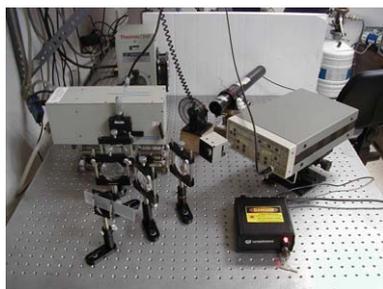
Hot carrier solar cell



QD based selective contacts



Photoreflectance characterization



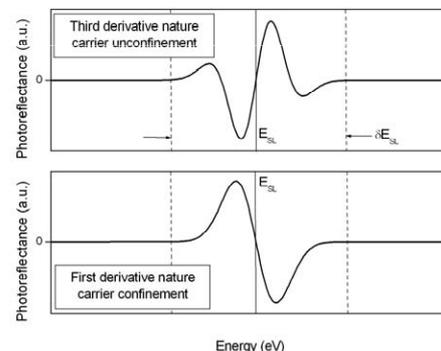
PR is a spectroscopy technique based on analysing the optical response of a material under a periodical light perturbation [Car69].

By PR we can analyse the band diagram of the QD based selective contacts.

Fitting procedures on PR can inform about carrier confinement [Can08]:

- Third derivative nature of PR features expected for unconfined systems.
- First derivative nature of PR features expected for confined systems.

In order to create a QD based selective contacts, the QDs should provide a set of non-confined carrier states, which should be evidenced by a third derivative PR feature.



Real dot-barrier configurations for selective contacts will show more than one isolated evacuation channel → Fit the theory?

Conclusions

PR is shown to be a powerful spectroscopy method in order to characterize the hot carrier solar cell selective contacts.

Selective contacts based on QDs will have particular signatures on PR such as third derivative nature.

[Luq08] *Electronic Letters* 31st July 2008 Vol. 44 No. 16.

[Wür97] *Solar Energy Materials and Solar Cells* 46 (1997) 43-52.

[Mar06] *Thin Solid Films* 511–512 (2006) 638–644.

[Car69] M. Cardona, "Modulation Spectroscopy", 1969 Academic Press NY

[Can08] 1CV.1.21, 23rd Eur. Phot. Sol. Ener. Conf. Valencia (Spain) 2008.

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