World's First Nanorod Solar Module: Materials Fancy Goes Reality!

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Introduction

For many years, solar cells had been considered as an inferior energy technology due to high cost – even in the renewable energy paradigm; however, progress in materials processing and engineering have helped them emerge as a frontline renewable energy technology with energy payback time that has been lowered from over a decade to a couple of years (at least in some parts of the world) during the last ten years. Commercial solar panels are typically manufactured on rigid platforms; fabricating them on flexible substrates, such as transparent plastics and metallic foils, would enable effective harvesting of energy in a number of diverse areas from indoor electronics to automobiles and from windows to portable applications. Furthermore, it would open up web-based roll-to-roll fabrication conducive to massive throughputs. Solution processable solar cells offer promising opportunities towards this end.

Benefits

- **Green technology**: Solar cells reduce CO_2 emission and thereby global warming.
- **Solution processable nanostructures at normal conditions** help building stable solar modules provides an opportunity to build cost effective PV technology.
- The methods employed in our study are compatible **to large area processing and could be developed on flexible substrates**.

Publications

- R. Jose et al, ACS Nano 9, 8420-8429, 2015 (IF ~ 13)
- R. Jose et al, Nanotechnology (invited paper), 2015 (IF ~3.5)
- R. Jose et al, J. Power Sources 283, 61-67, 2015 (IF ~6.6)
- R. Jose et al, Nanotechnology 26, 105401, 2015 (IF ~3.5)
- Star online (Local Newspaper)

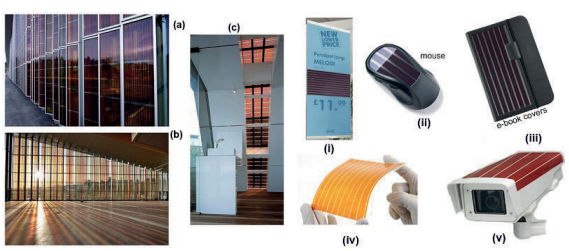
Invention

Vertically aligned nanorods grown on conducting glass substrates offer attractive charge transport properties for fabrication of solar cells; many nanorod based laboratory solar cells are published in open literature – as a material fancy. No practical solar module have so far been realized because they are hard to be patterned for module fabrication. We have grown nanorods with an interlayer, which facilitated patterning. Please see the results.

Novelty

World's first nanorod solar module.

Marketability



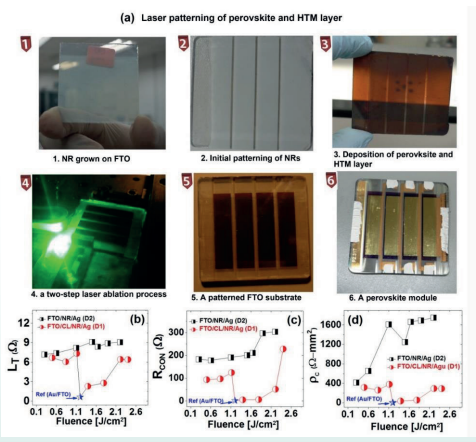
- Indoor electronics, low light applications.
- Building and automobile integrated photovoltaics.
- Flexible, wearable and portable electronics.

Source: R. Jose et al., Energ. Environ. Sci. 2014. 7, 3952

Patent

- R. Jose, et al., MY-156089-A Dated 15 Jan 2016
- R Jose et al, patent filed.

Characteristics of world's first solar module



- NRs are ablated using a precise laser power and via interfacial engineering.
- Two architectures D1 (FTO/NR) and D2 (FTO/IL/NRs) were attempted for laser ablation.
- Short Nd:YVO_4 laser pulses were applied for ablation.
- TLM measurements shows optimal resistance of substrates for module fabrication.

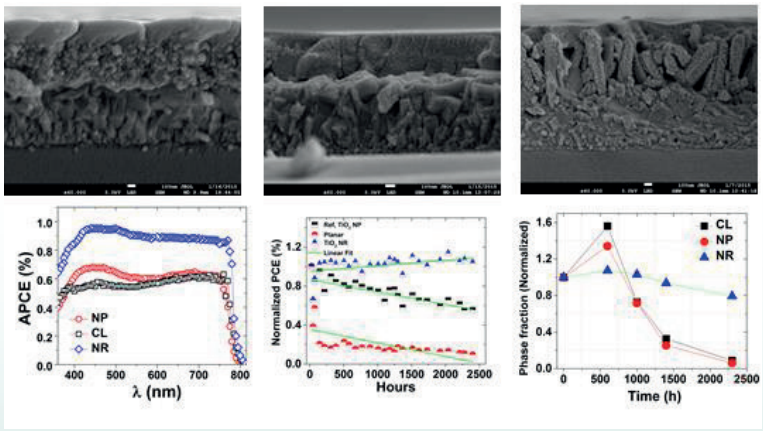


Figure: (a-c) shows the cross section of the three devices (NP, planar, and NR), (d) internal quantum yield of the three PSMs, (e) long term photovoltaic parameters of three types of perovskite solar modules over aging and (f) shows the phase fraction of left-over perovskite after 2500 h.

Funding