Multiwall carbon nanotube/nickel oxide nanocomposite coatings: Sol-gel deposition and characterization

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our future through science

Fire wood is the traditional fuel in most rural Africa

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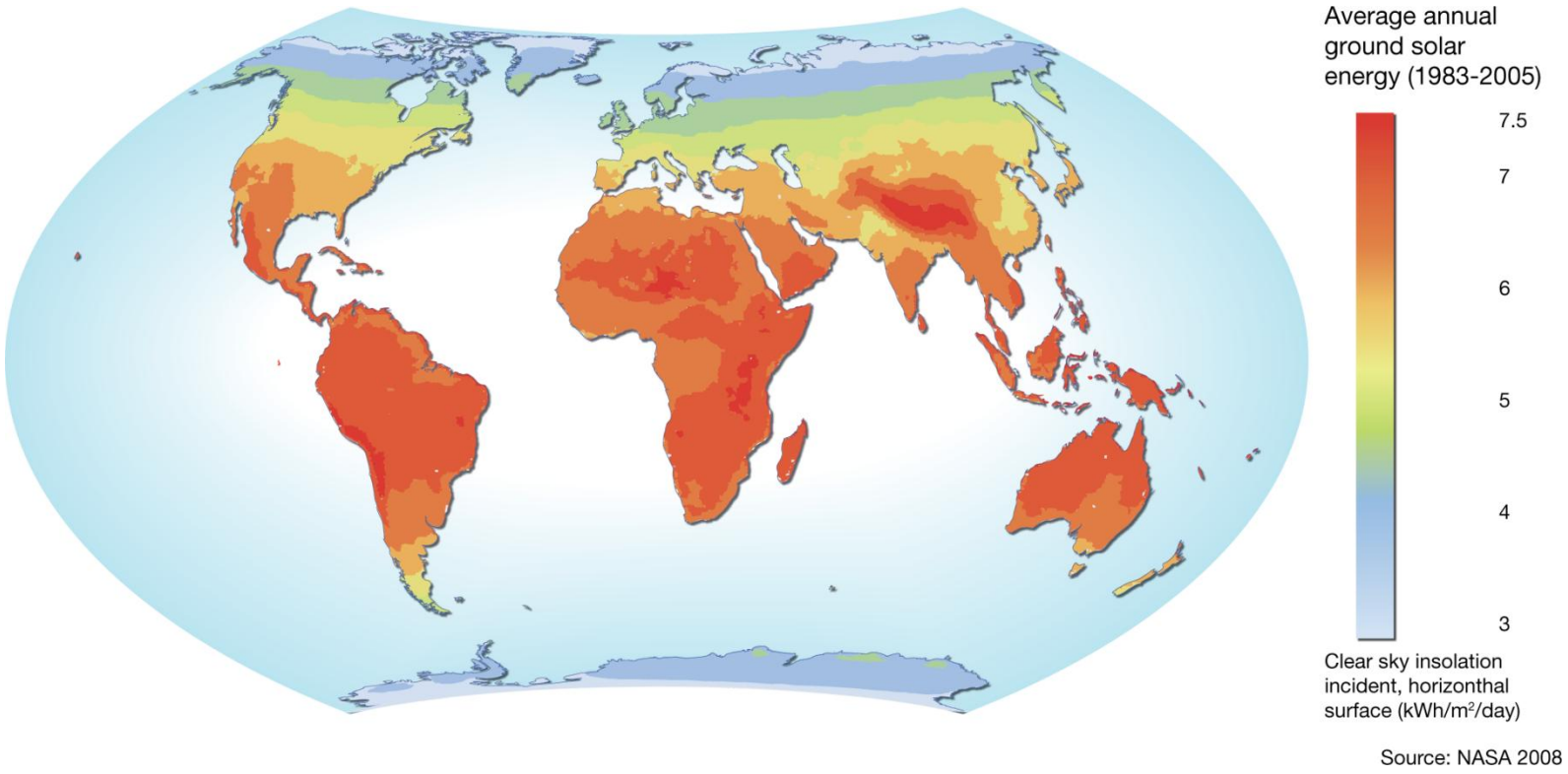
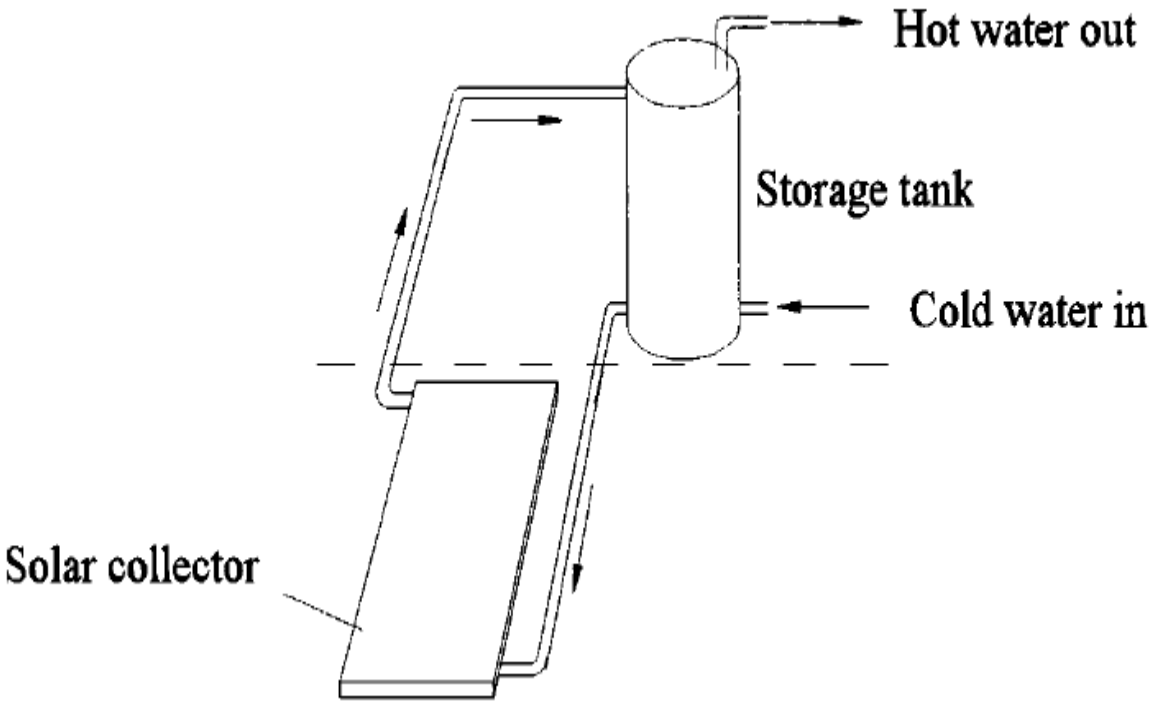
Most of African countries ~ 325 days of strong sunlight



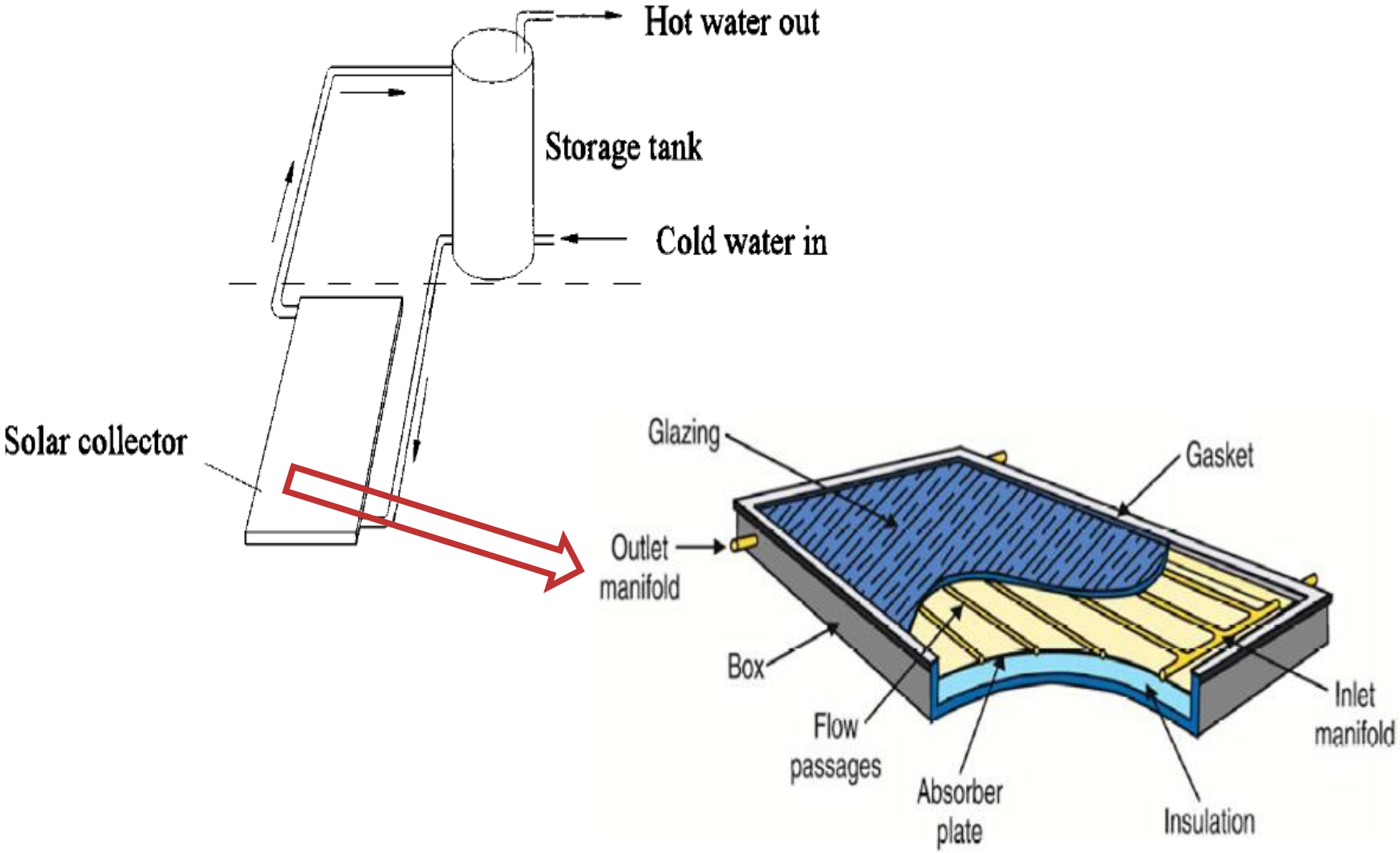
Source: NASA

Challenge: harnessing solar power more effectively and efficiently, to reduce dependence on traditional/fossil fuels

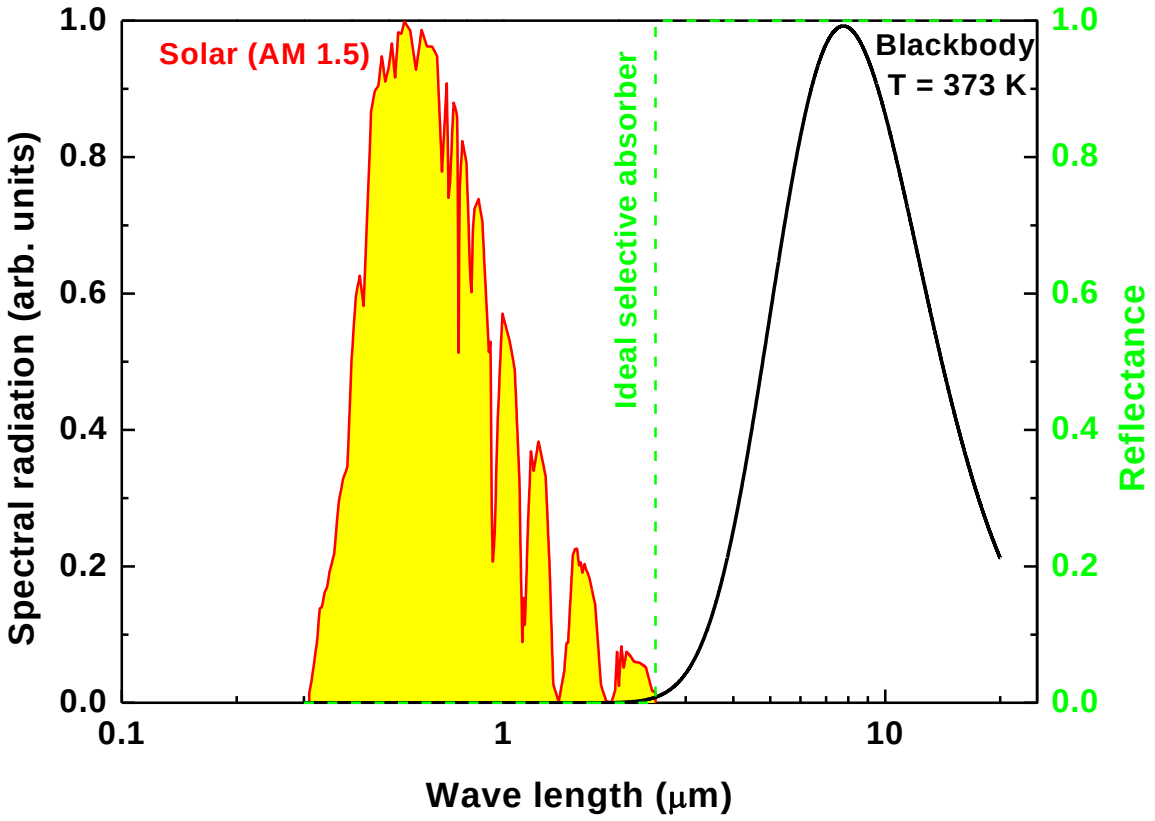
Solar thermal energy is a technology for harnessing solar energy for thermal energy (heat)



Solar thermal collectors for water heating use a spectrally selective surface that absorb sunlight and convert it to heat



Fundamentals: Optical Selectivity



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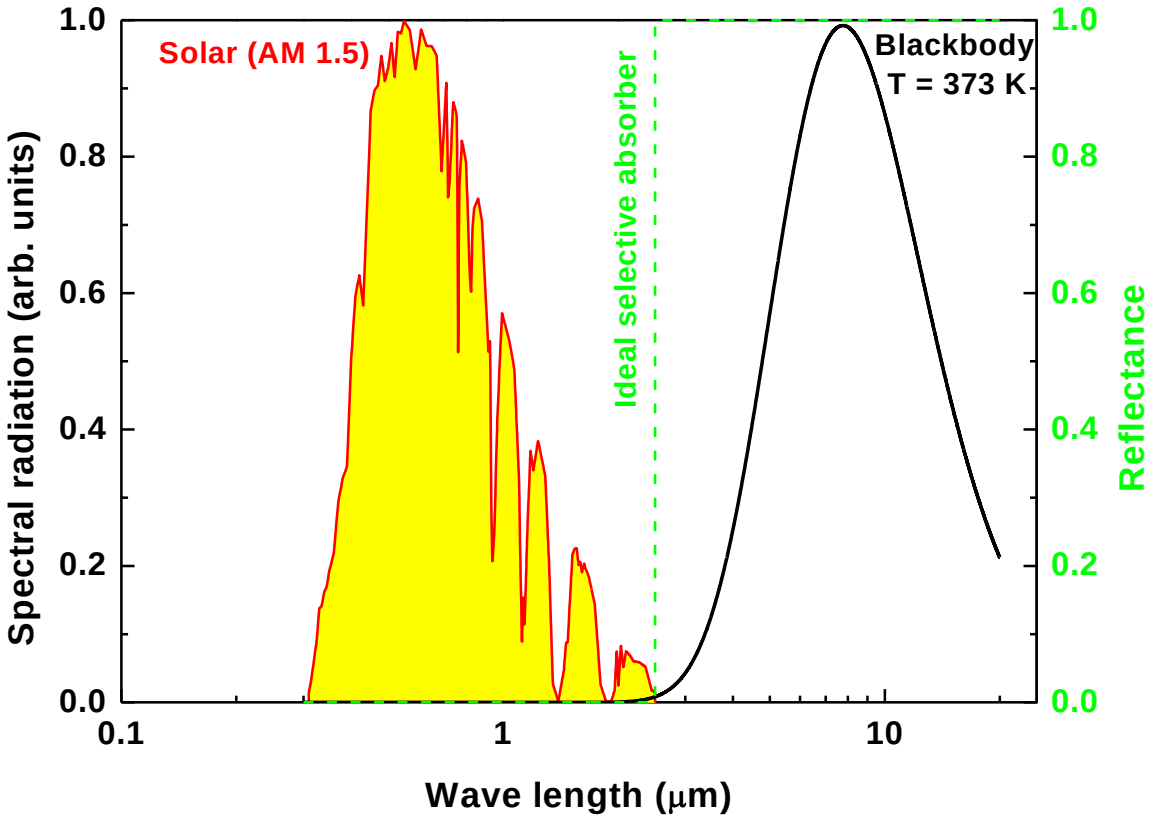

The power density ,P, of thermal radiation emitted by a black body of temperature T is

$P = \sigma T^4$, $\sigma = 5.67 \times 10^{-8}$ W/m^{2}K^4 (1)

(Stefan-Boltzmann law)

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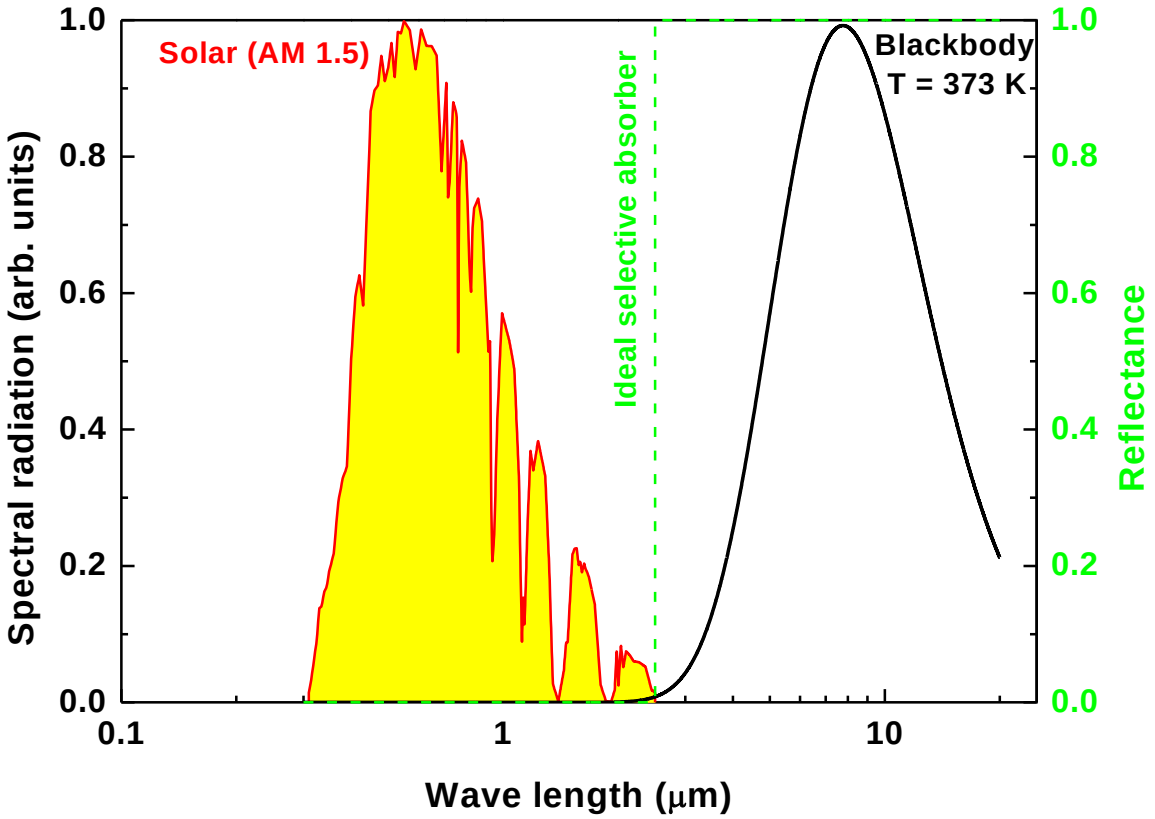

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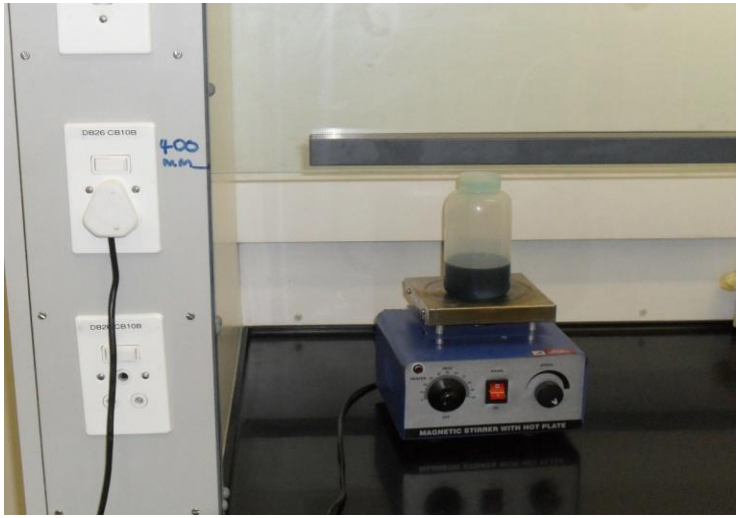
At T = 80 °C, from eq. (1), P ~ 900 W/m^2 ~ incident solar energy at the ground

→ An optically selective surface is required

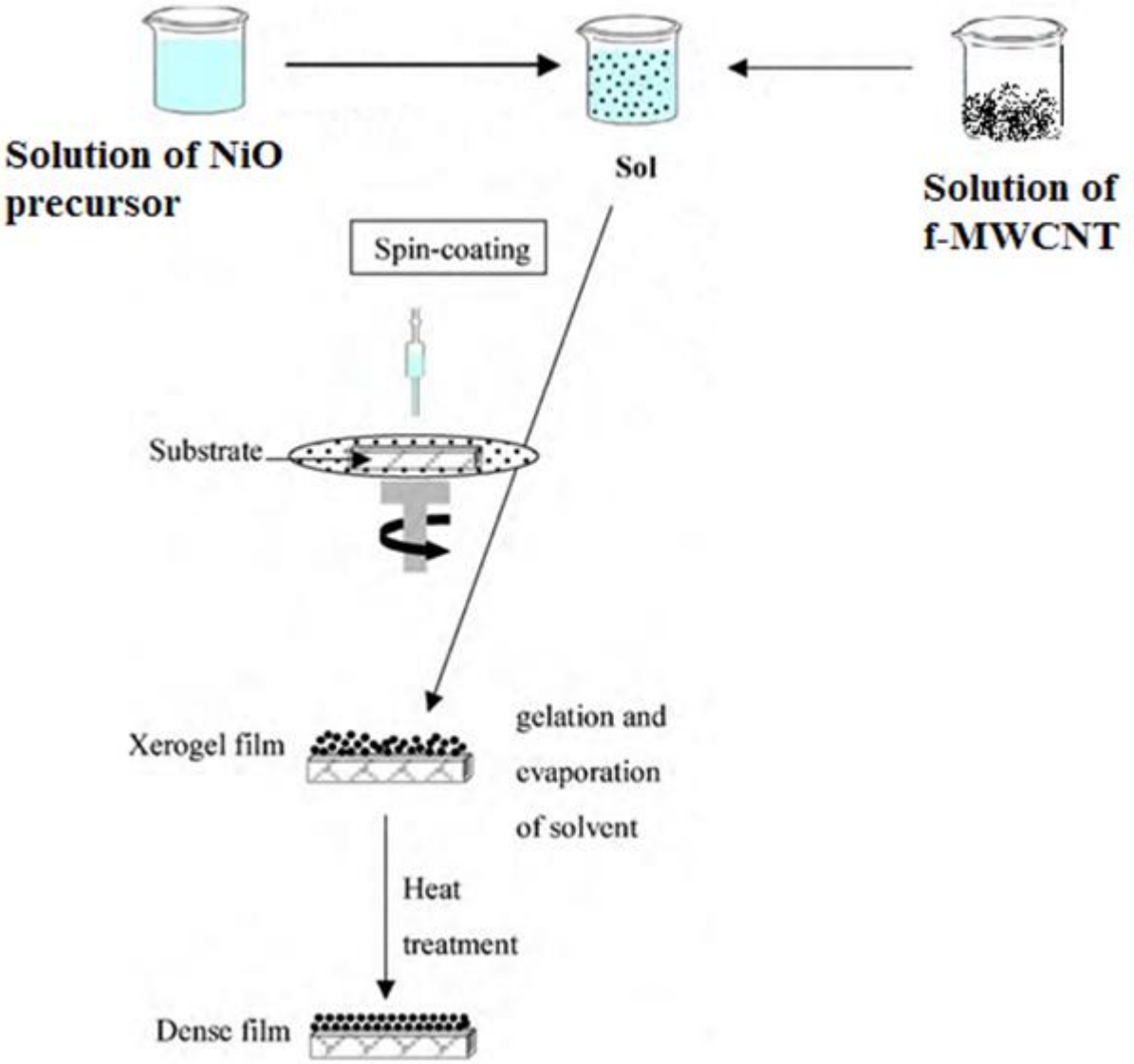
Samples were fabricated in a simple 3 step procedure



An overview of the **sol-gel** synthesis used in this study

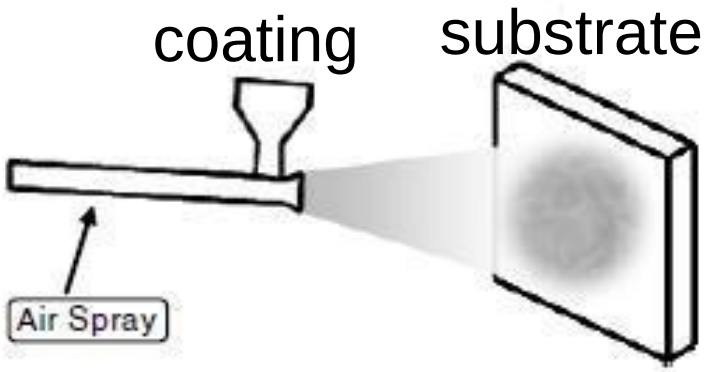
Precursors:

- Nickel acetate
- Ethanol
- Diethaloamine
- Poly ethylglycol
- F-MWCNT
- Distilled water



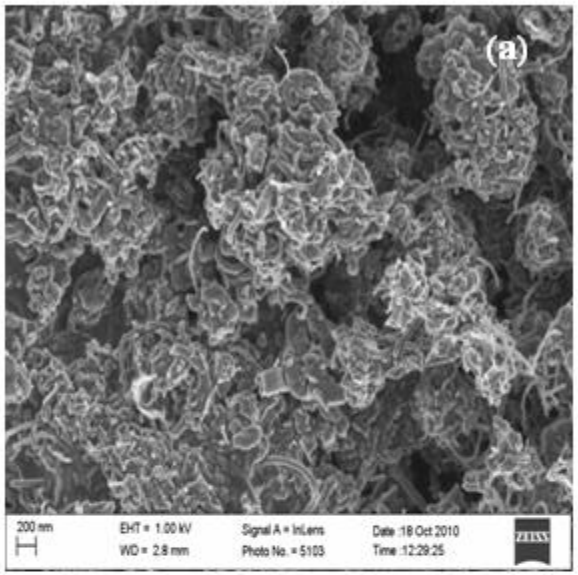
Sol-gel can be adapted to large scale coating techniques

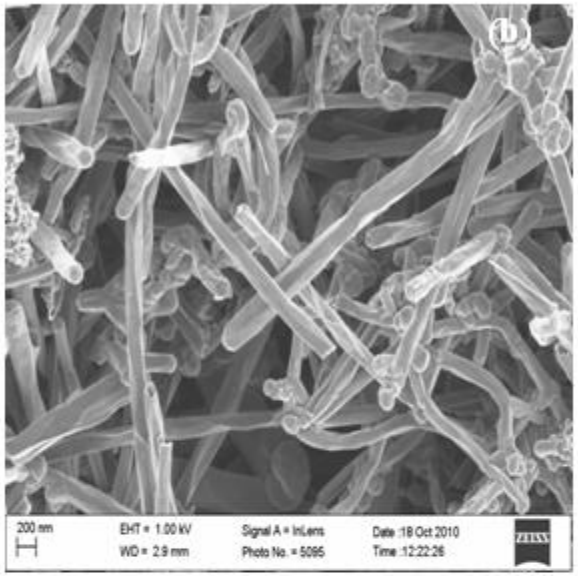
Spin coating

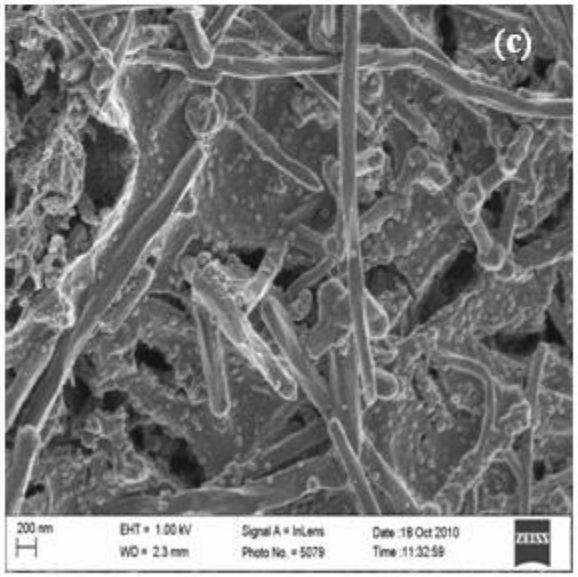


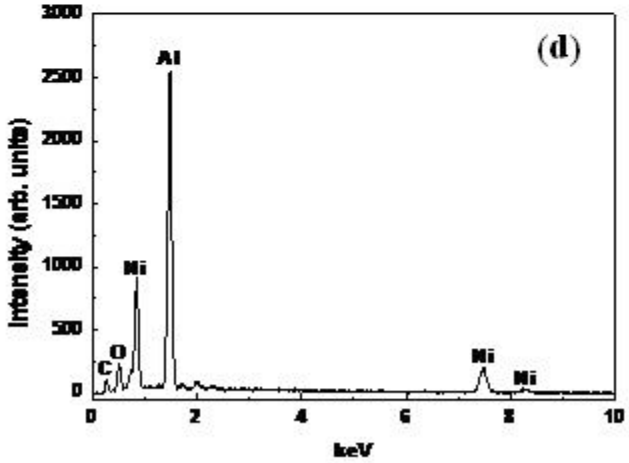
Spray coating

Characterization: SEM

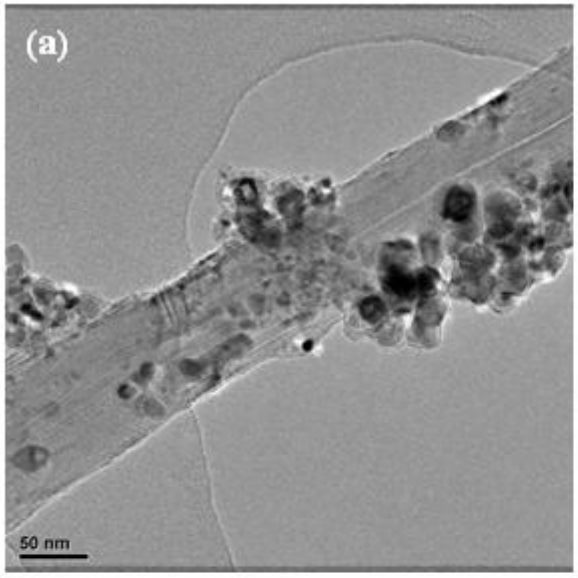


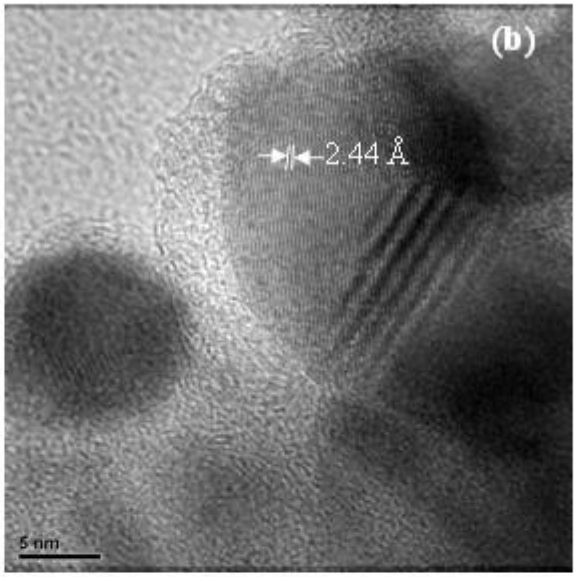


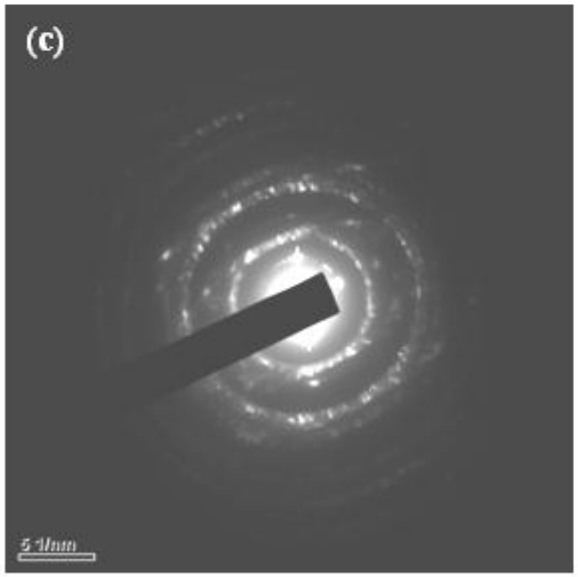


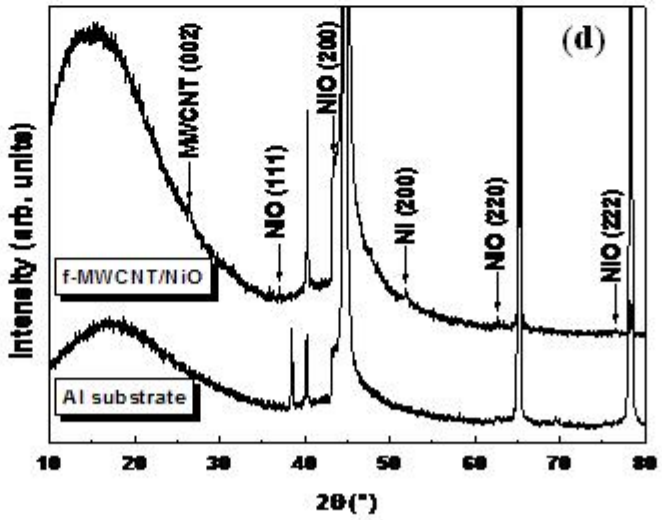


Characterization: TEM

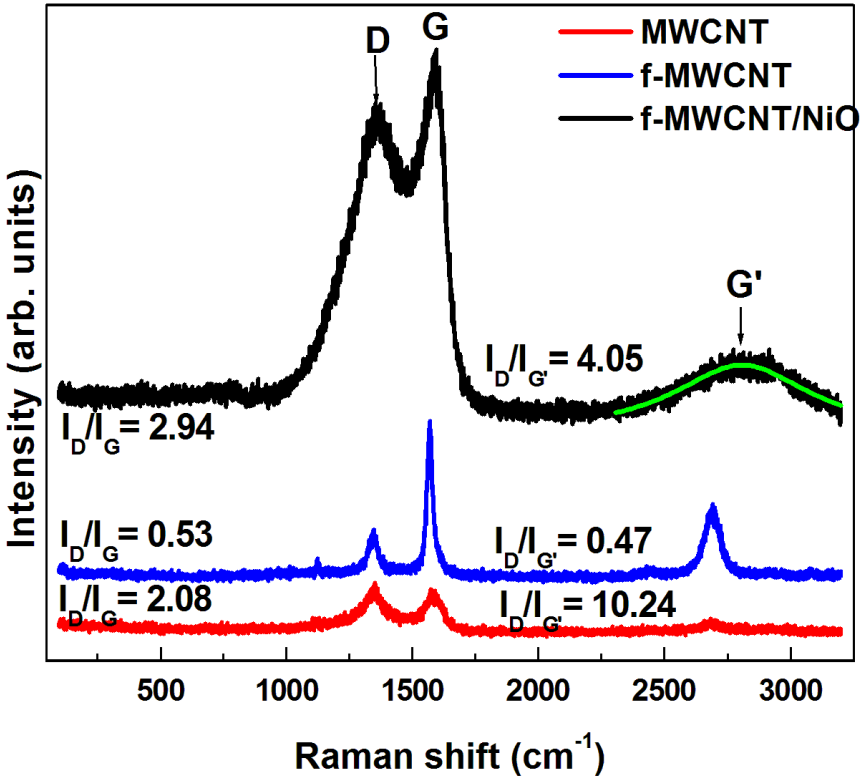


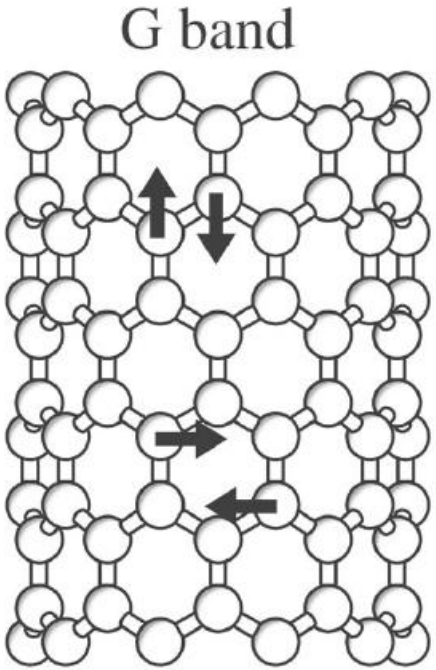




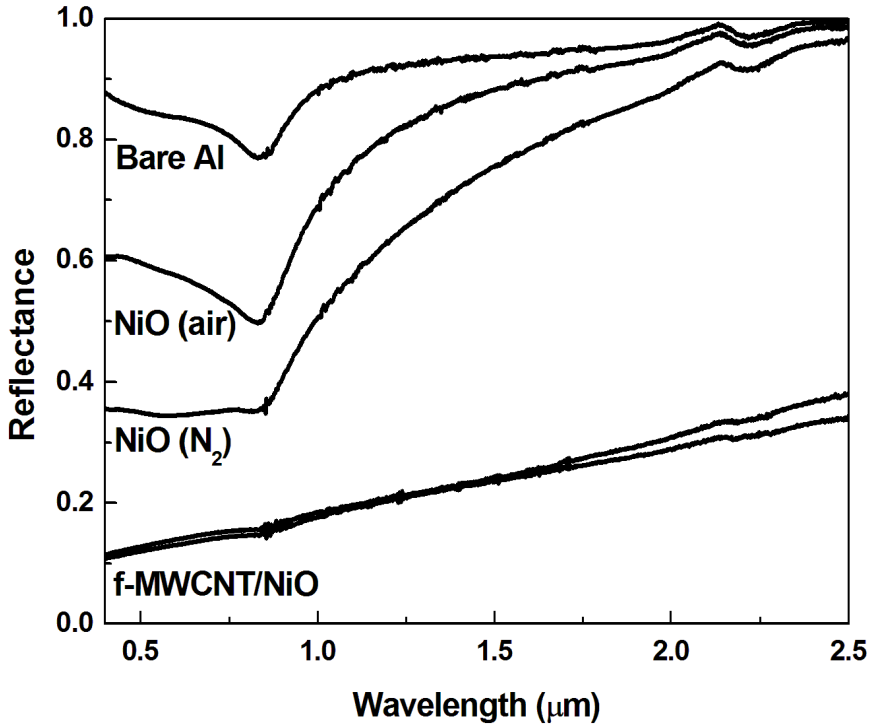


Characterization: vibrational properties

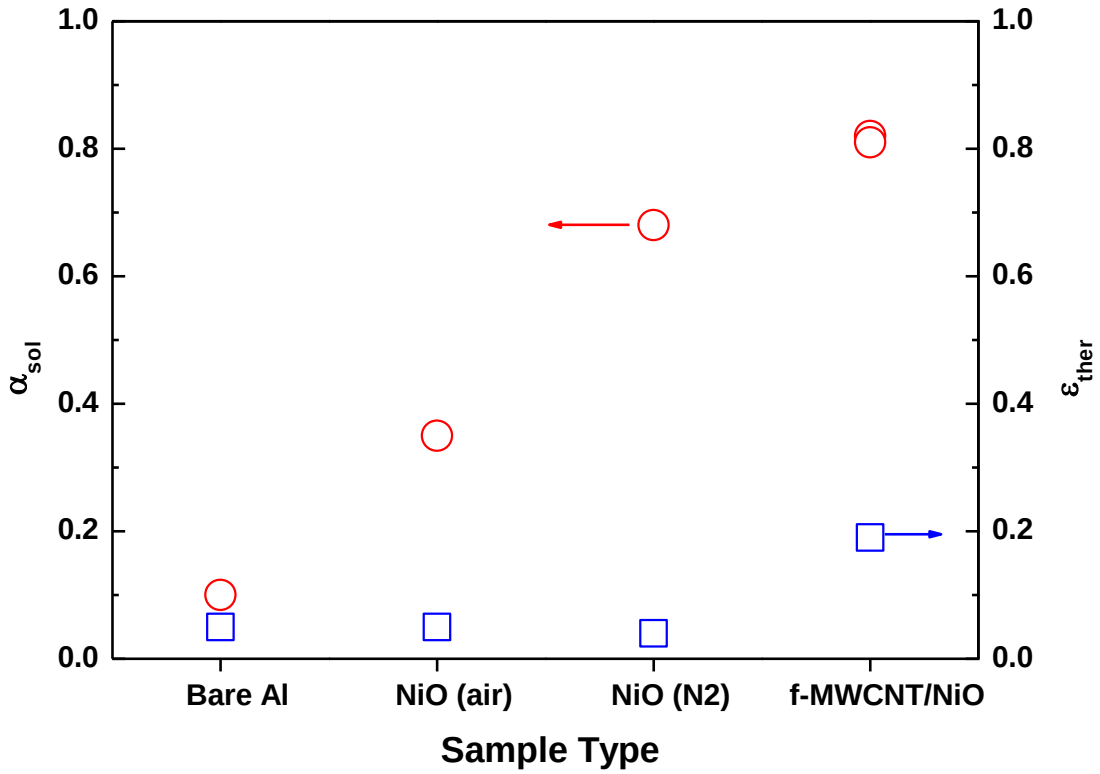




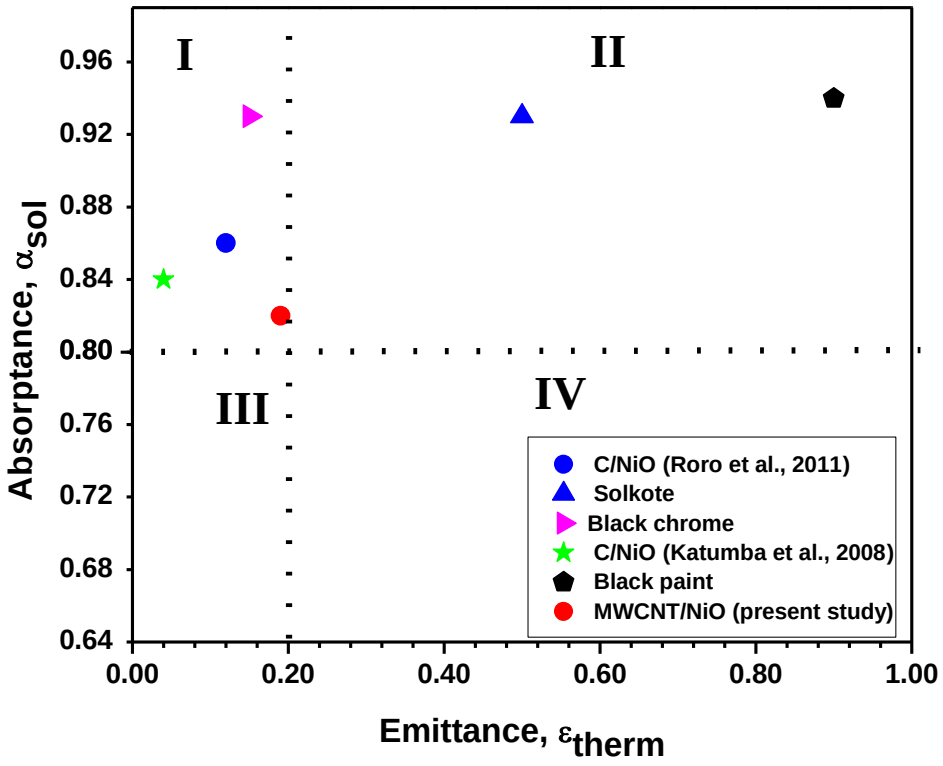
Characterization: Reflectance



Addition of MWCNT improves the solar absorption of our samples

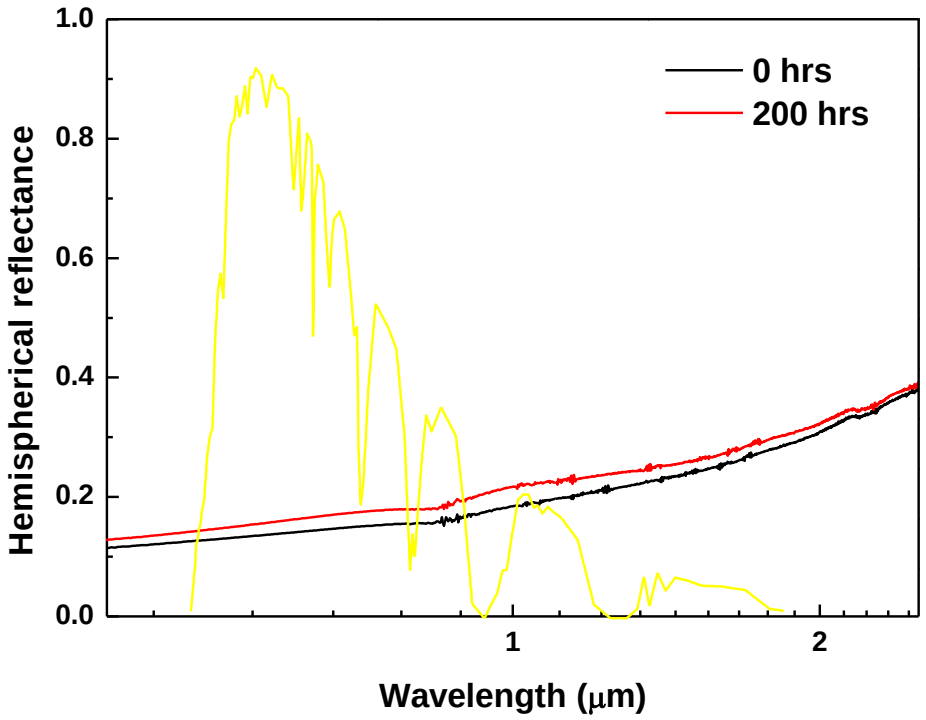


Our sample falls in class I indicating higher selectivity



G. Katumba *et al*. Sol. Energy Mater. Sol. Cells 92 (2008) 1285–1292

Accelerated aging @ 250 °C in air: the change in reflectance spectra after tempering is much smaller



“I’d put my money on the sun and solar energy. What a source of power! I hope we don’t have to wait ‘til oil and coal run out before we tackle that.”

Thomas Edison

Thank you for listening!