

Fabrication of MWCNT/NiO nanocomposite thin films for optically selective solar absorbers

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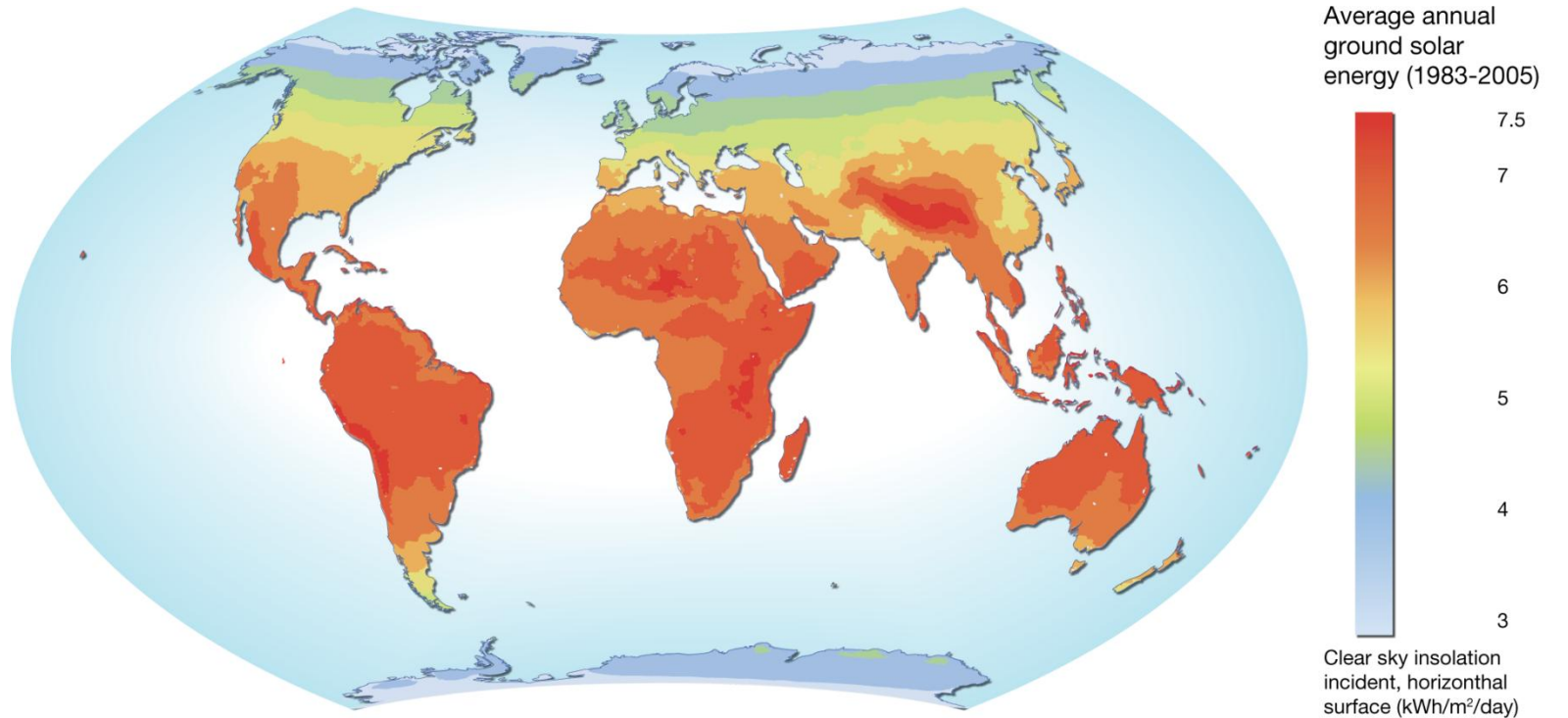
Fire wood is the traditional fuel in most rural Africa



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Most of African countries ~ 325 days of strong sunlight



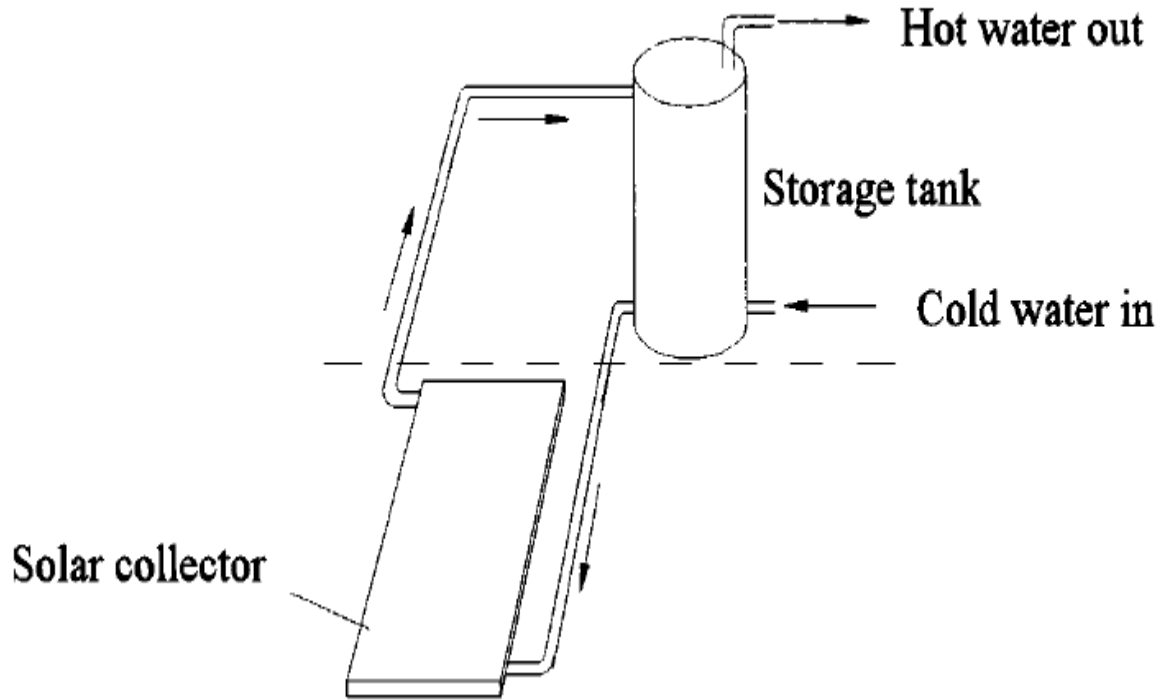
Source: NASA 2008

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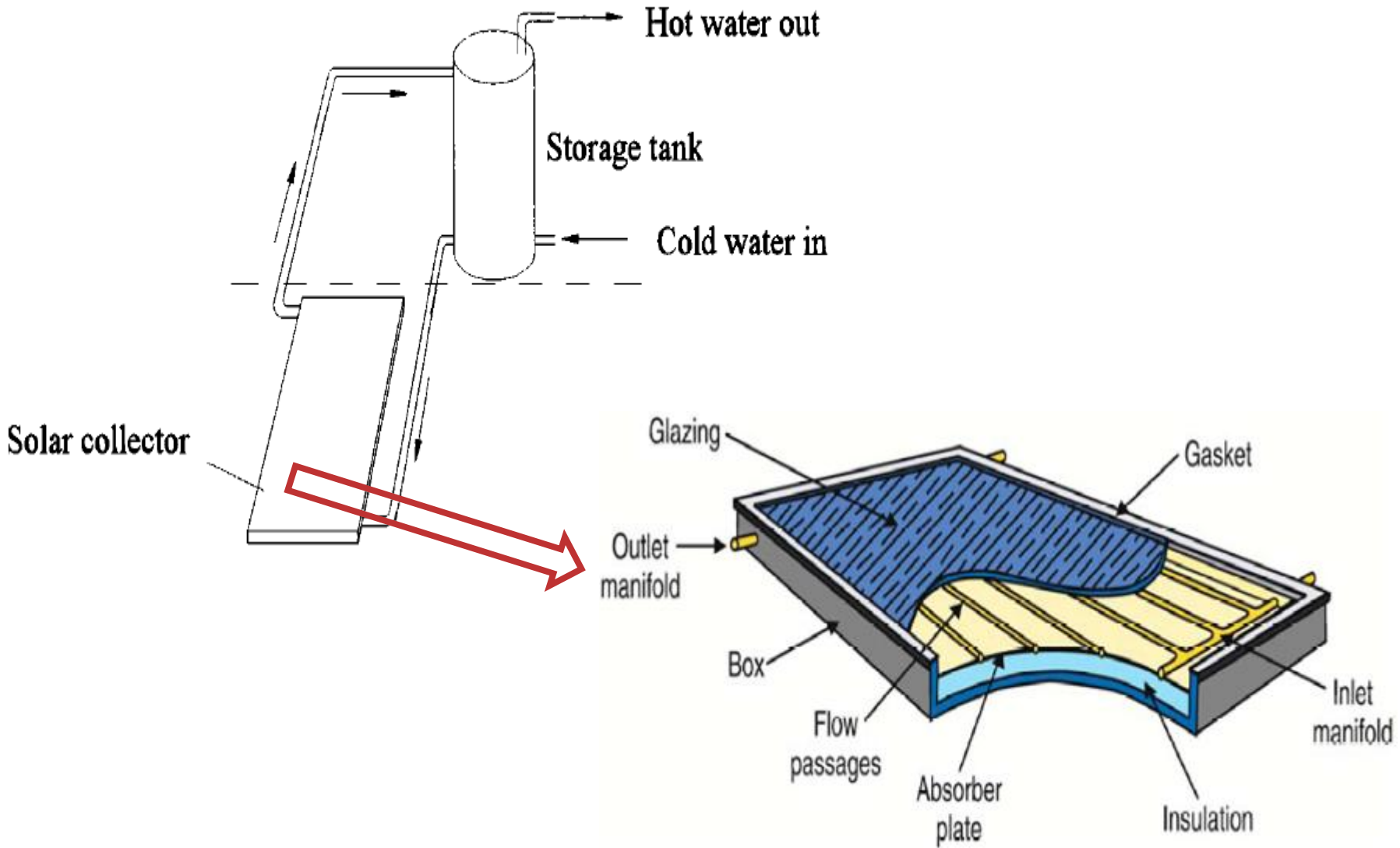
Challenge: harnessing solar power more effectively and efficiently, to reduce dependence on traditional/fossil fuels



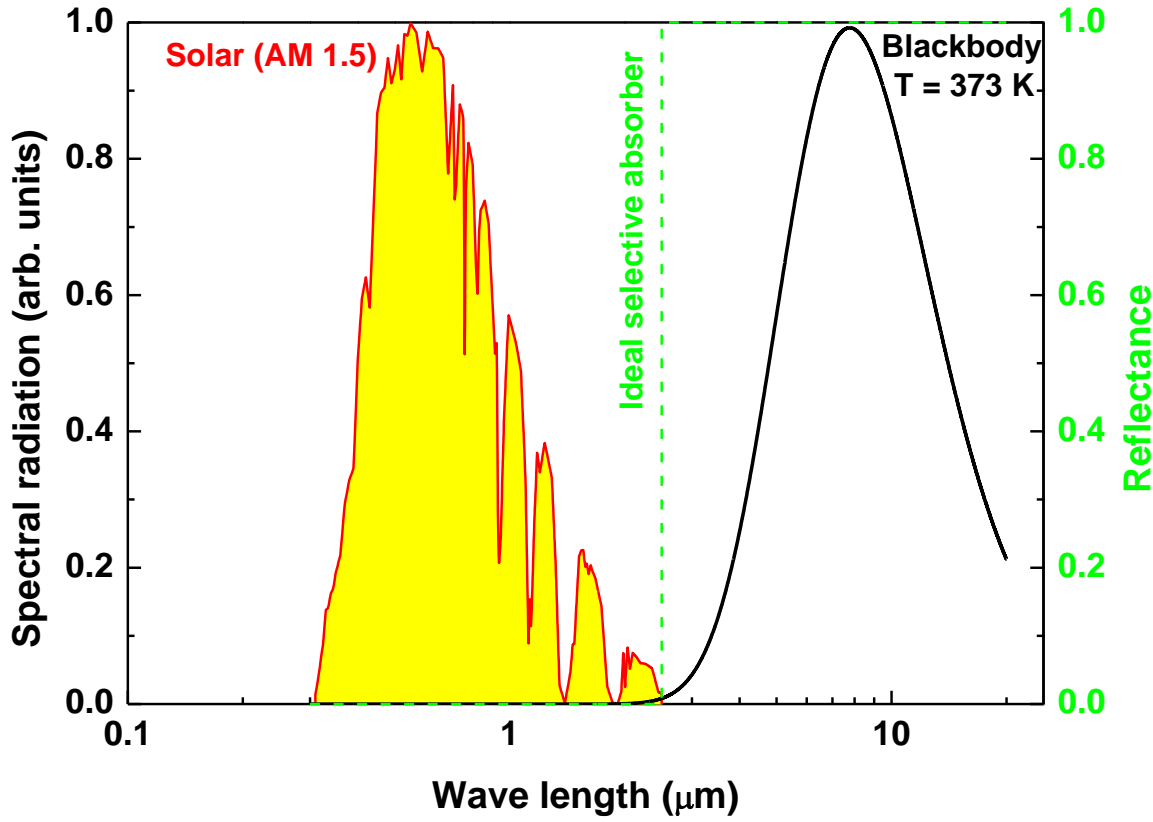
Solar thermal energy is a technology for harnessing solar energy for thermal energy (heat)



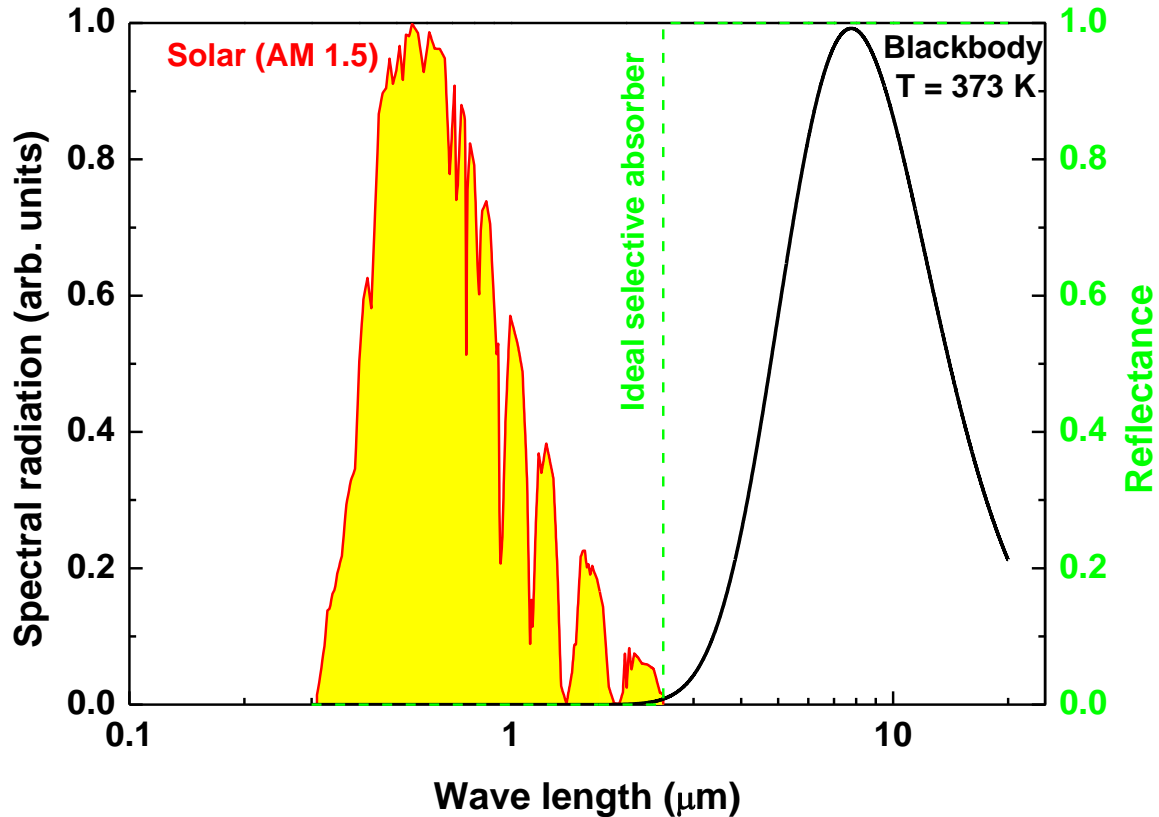
Solar thermal collectors for water heating use a spectrally selective surface that absorb sunlight and convert it to heat



Fundamentals: Optical Selectivity



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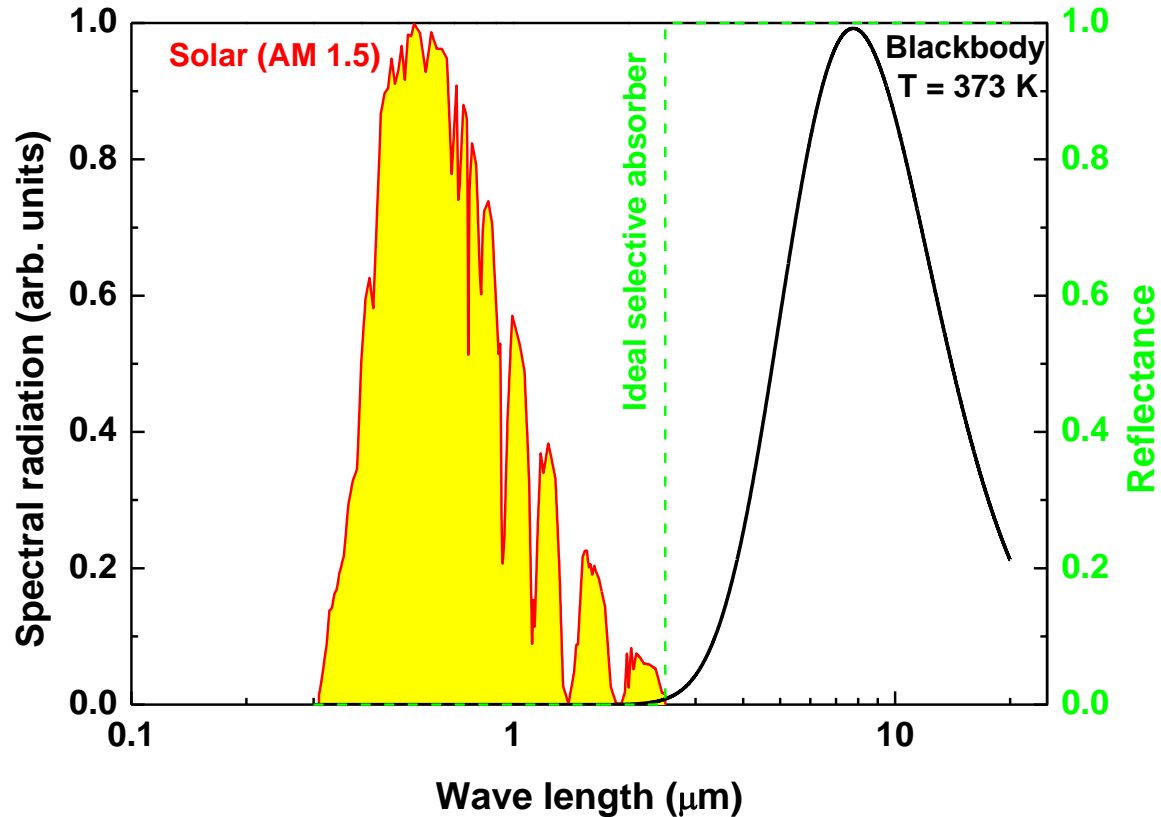


The power density , P , of thermal radiation emitted by a black body of temperature T is

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

(Stefan-Boltzmann law)

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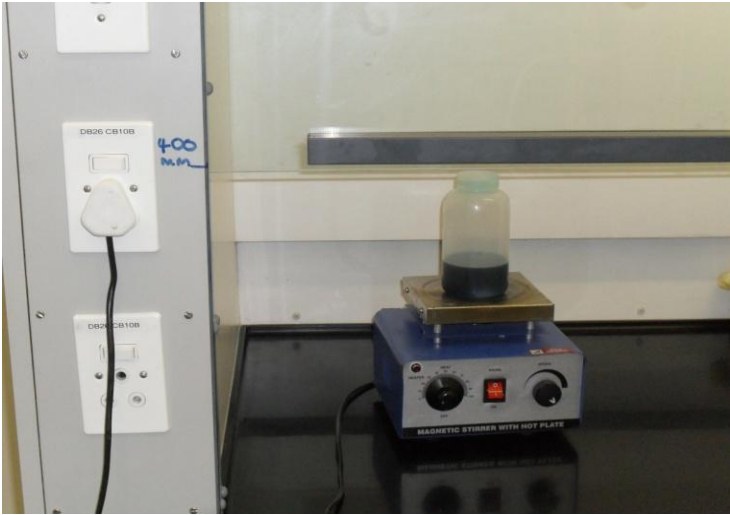
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At $T = 80 \text{ }^\circ\text{C}$, from eq. (1), $P \sim 900 \text{ W/m}^2 \sim$ incident solar energy at the ground

→ An optically selective surface is required

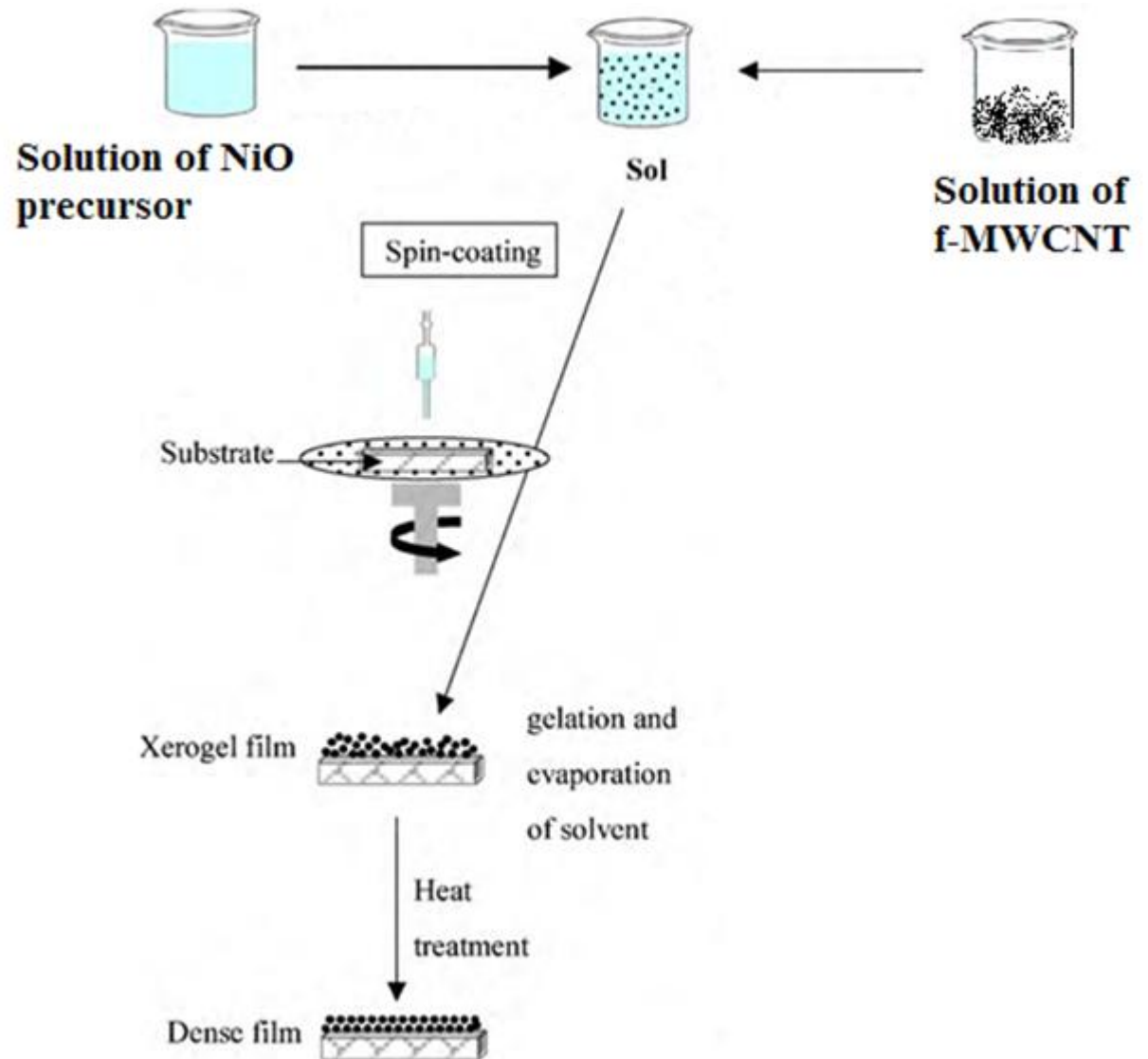
Samples were fabricated in a simple 3 step procedure



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

Precursors:

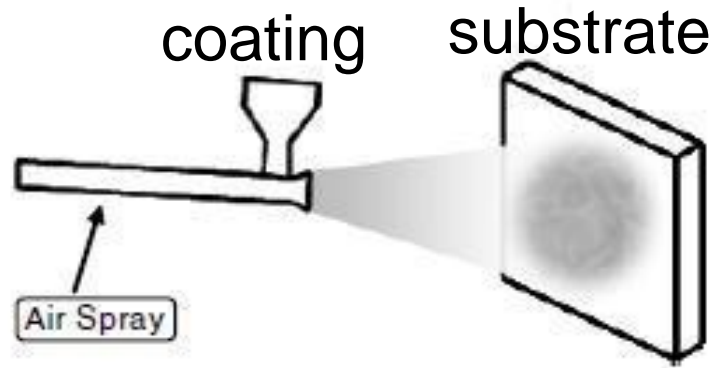
- Nickel acetate
- Ethanol
- Diethaloamine
- Poly ethylglycol
- F-MWCNT
- Distilled water



Sol-gel can be adapted to large scale coating techniques

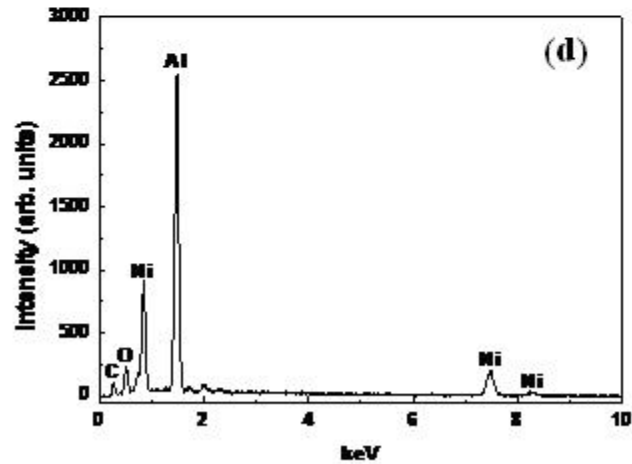
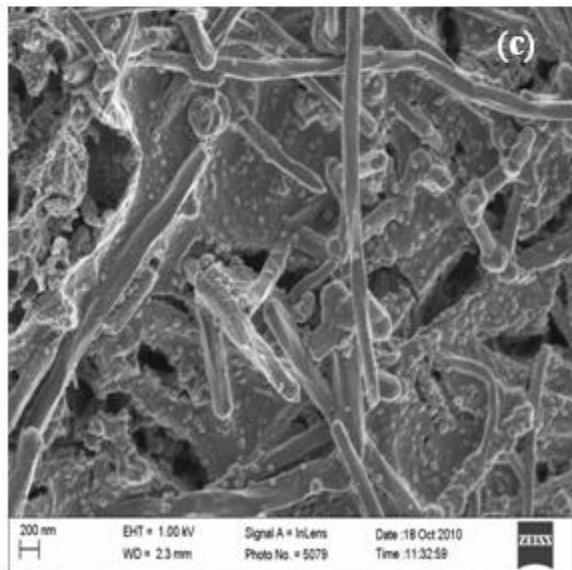
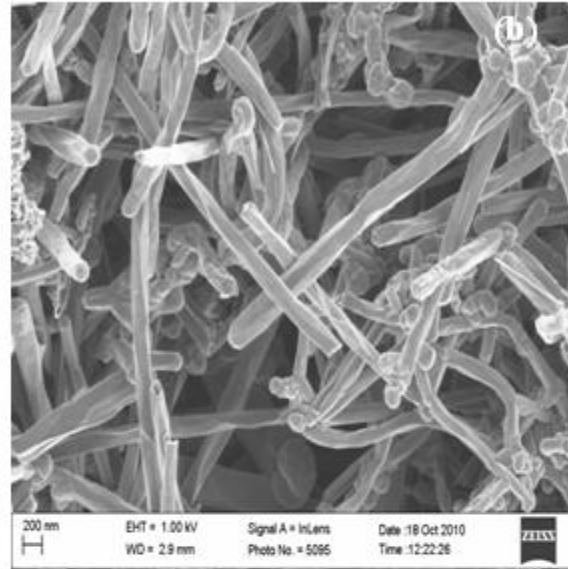
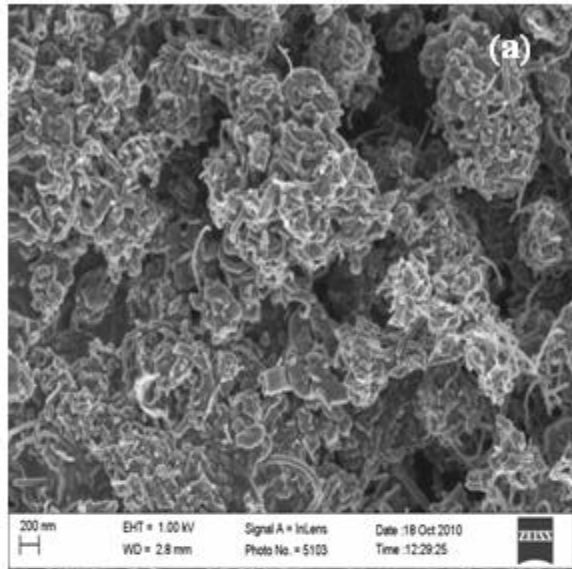


Spin coating

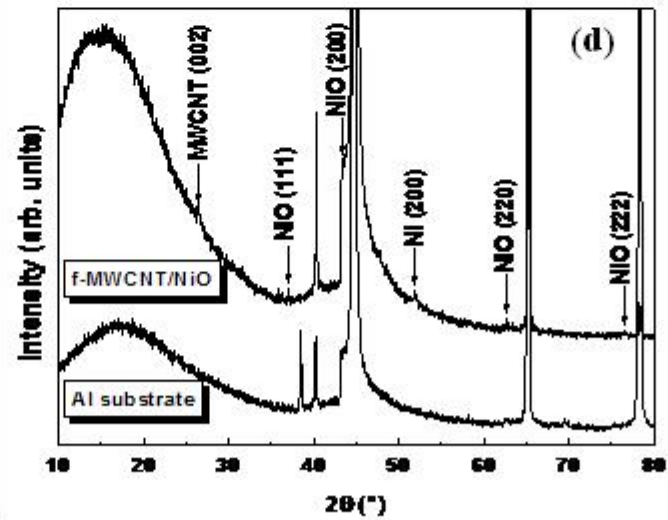
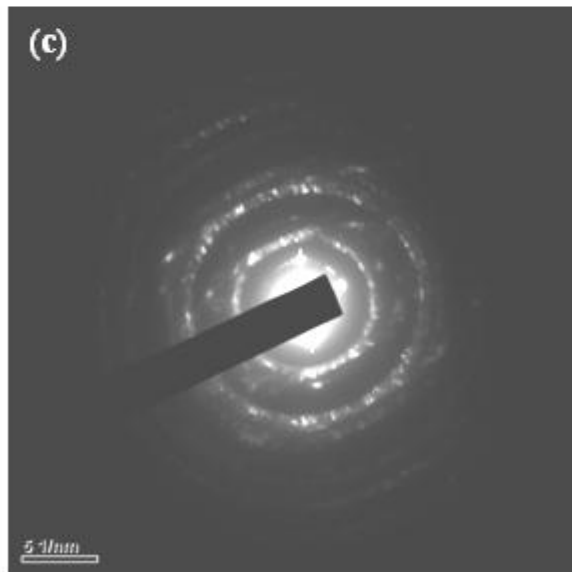
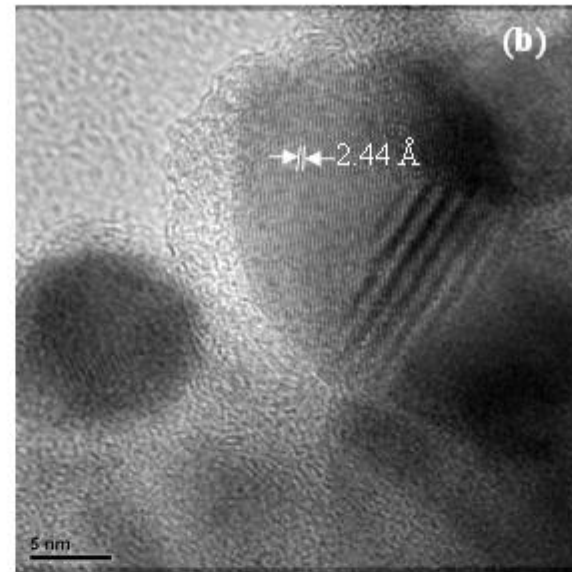
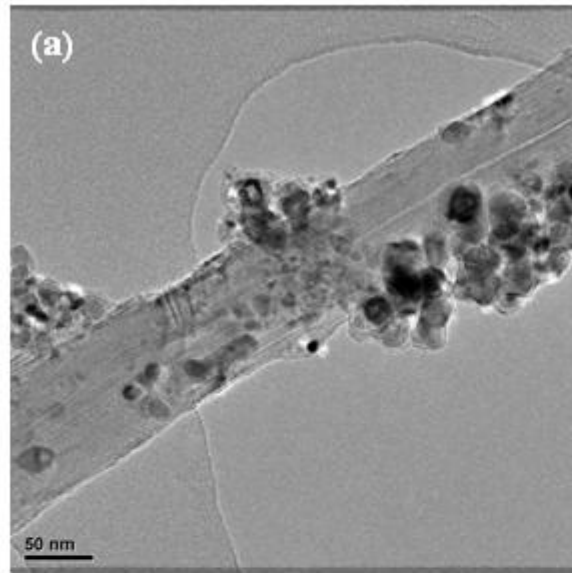


Spray coating

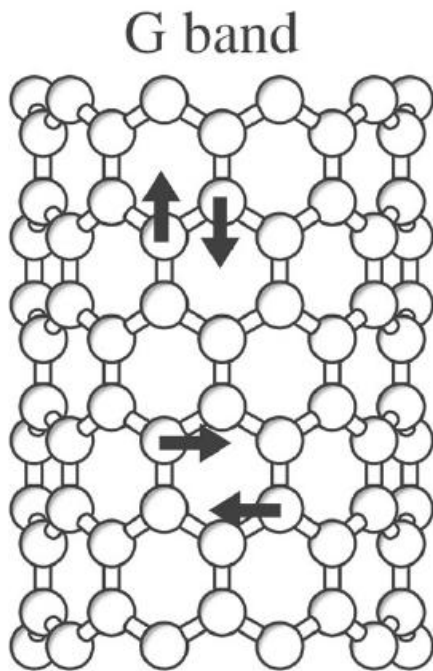
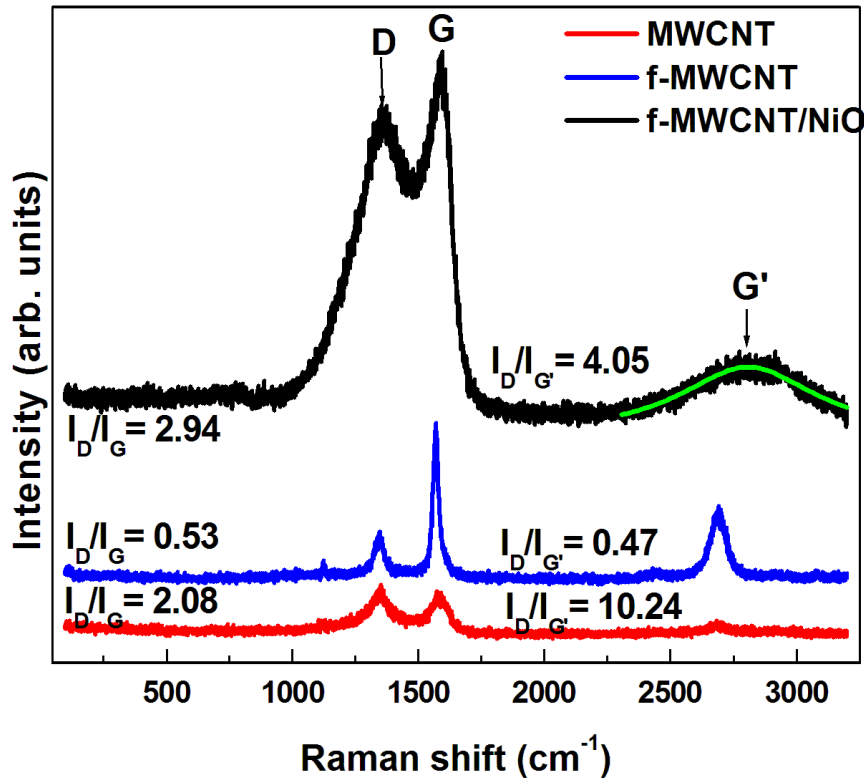
Characterization: SEM



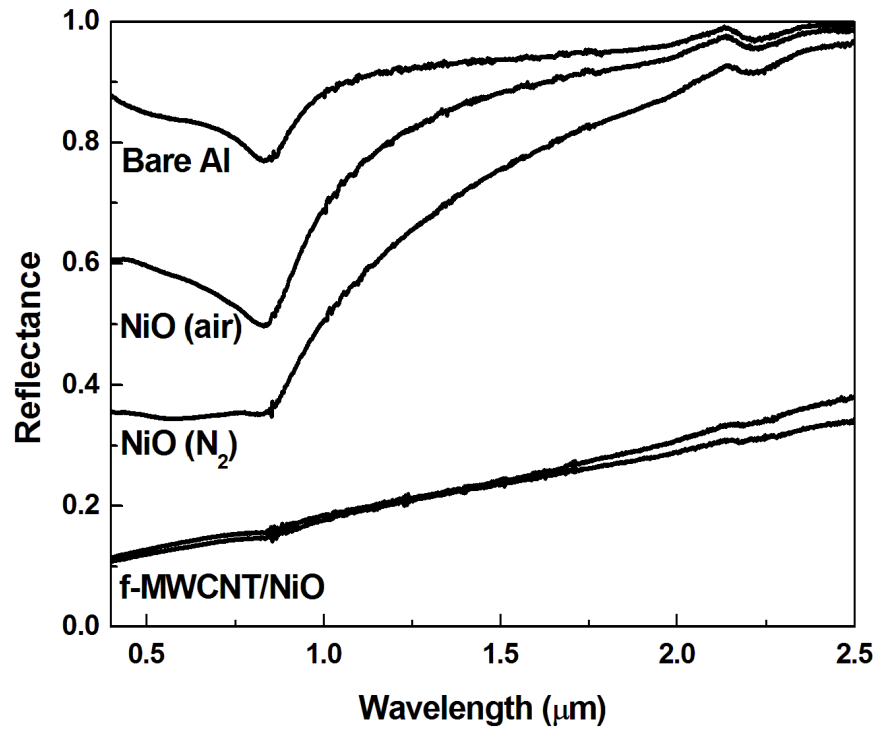
Characterization: TEM



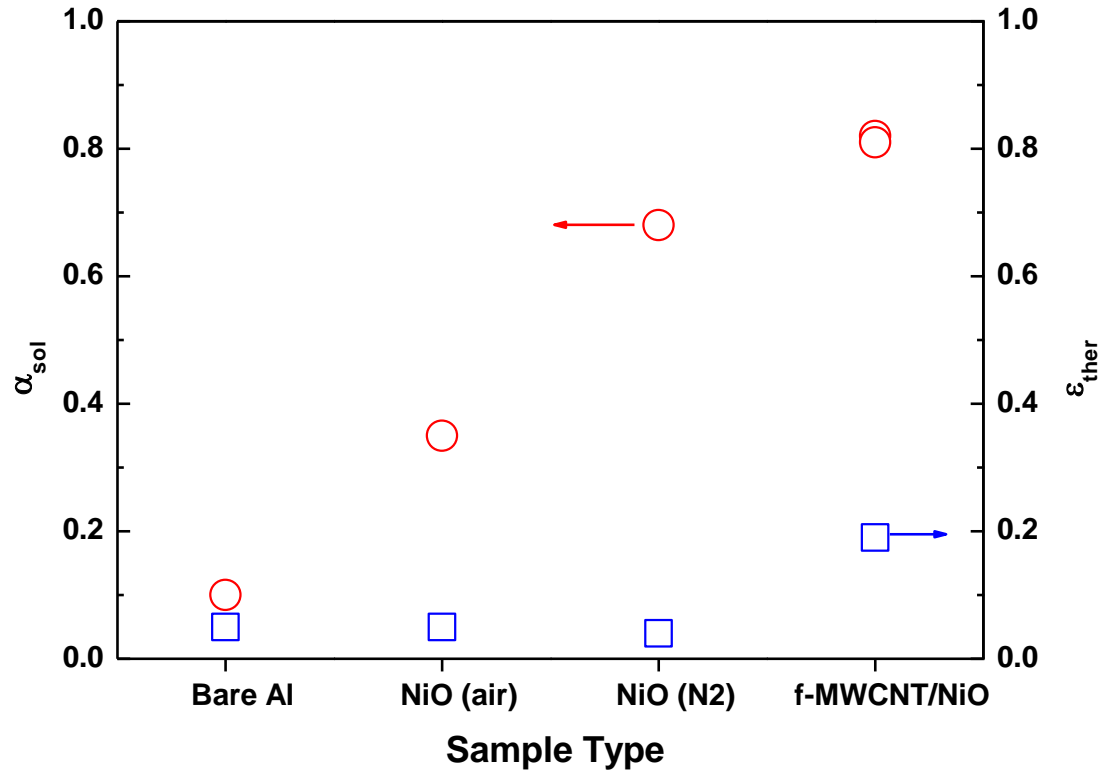
Characterization: vibrational properties



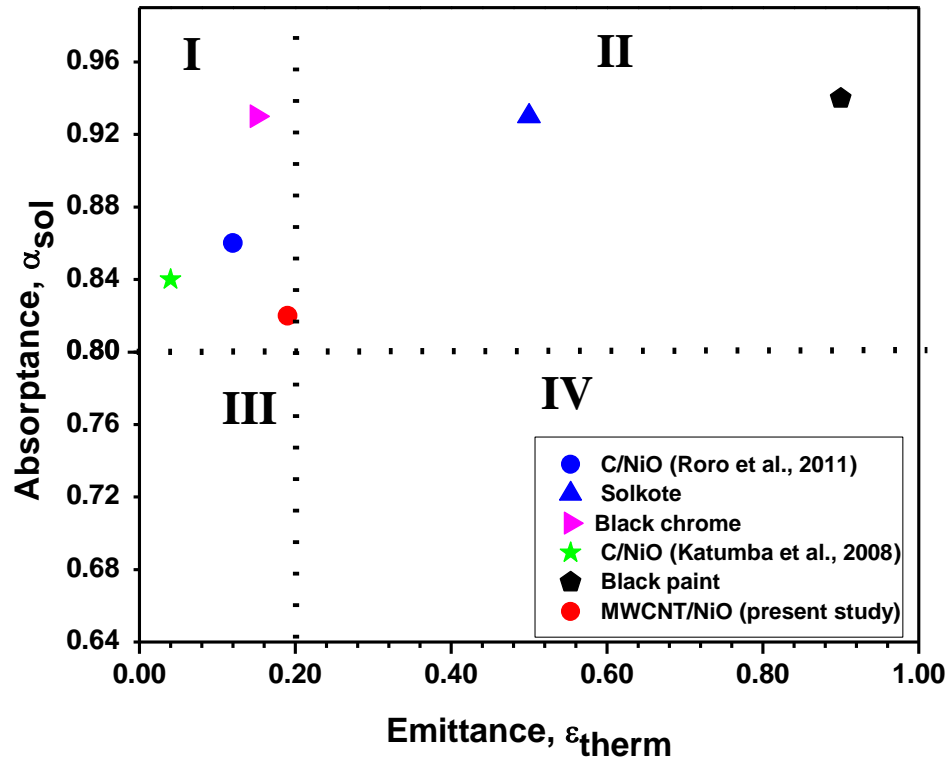
Characterization: Reflectance



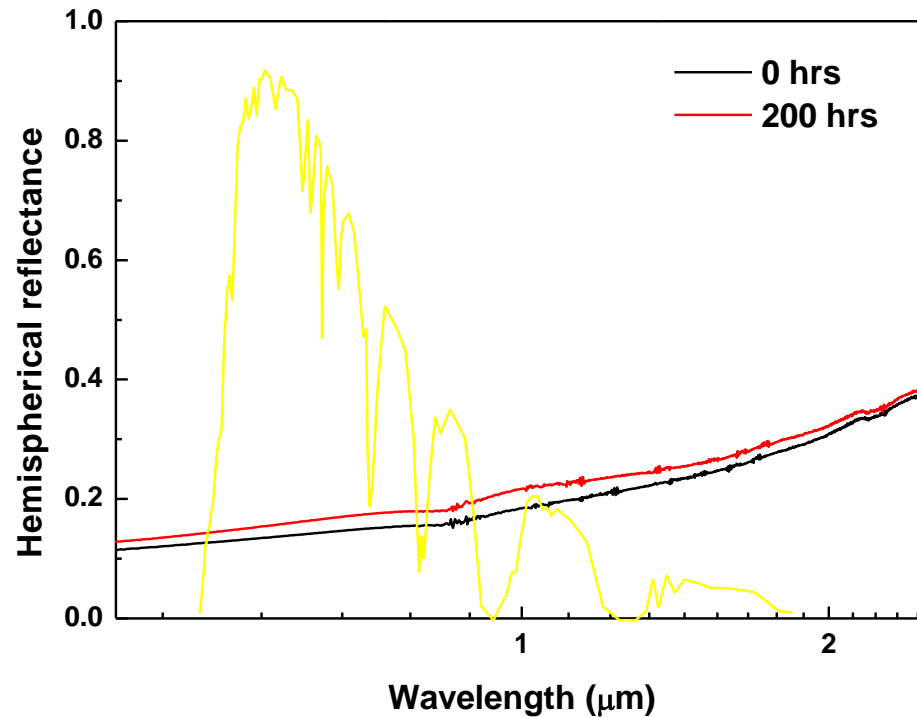
Addition of MWCNT improves the solar absorption of our samples



Our sample falls in class I indicating higher selectivity



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!

