Pulsed laser deposition of multiwall carbon nanotube/NiO nanocomposite thin films

Brian Yalisi\textsuperscript{1,2}, Kittessa Roro\textsuperscript{1}, Ngcali Tile\textsuperscript{1,2} and Andrew Forbes\textsuperscript{1,2,3}

\textsuperscript{1}CSIR- National Laser Centre, Pretoria, SA
\textsuperscript{2}School of Physics, University of KwaZulu Natal, Durban, SA
\textsuperscript{3}School of Physics, University of Stellenbosch, Cape Town, SA

SAIP 2011
Solar energy available in abundance, but....

[Diagram of a solar panel to heat water, showing sun rays, a solar panel, a water pipe, and inlet and outlet for cool and warm water.]
Fundamentals of solar absorbers

- Solar (AM 1.5)
- Blackbody
  \( T = 373\) K
- Reflectance
Fundamentals of solar absorbers

Spectral radiation (arb. units)
Wave length (μm)

Solar (AM 1.5)
Ideal selective absorber
Blackbody
T = 373 K
Solar (AM 1.5)
Reflectance

Composite layer
Aluminium substrate
Due to their excellent properties CNTs are best candidate to be an absorbing elements in the composite
“stoichiometric transfer” makes PLD a suitable candidate for the composite growth
Nd:YAG laser
Freq: 10Hz
Wavelength: 266 nm
Energy: 60 mJ/pulse
Pulse Width ~ 6 ns
Experimental results

MWCNTs are decorated with NiO indicating successful composite formation.
The new composite material exhibit new vibrational properties different from the constituents.
Typical reflectance spectrum shows better selectivity of our coatings

\[ \alpha = \frac{\int [R(\lambda)(1 - r(\lambda))]d\lambda}{\int R(\lambda)d\lambda} \]

\[ \varepsilon = \frac{\int [R(\lambda)(1 - r(\lambda))]d\lambda}{\int R(\lambda)d\lambda} \]
Nucleation and thin film growth

\[ \alpha = k \frac{d}{\lambda} \]

Substrate temperature (°C)

Our samples have shown excellent adhesion to the substrate
No change in solar absorptance suggesting our materials are promising for solar absorber application
THANK YOU!!!