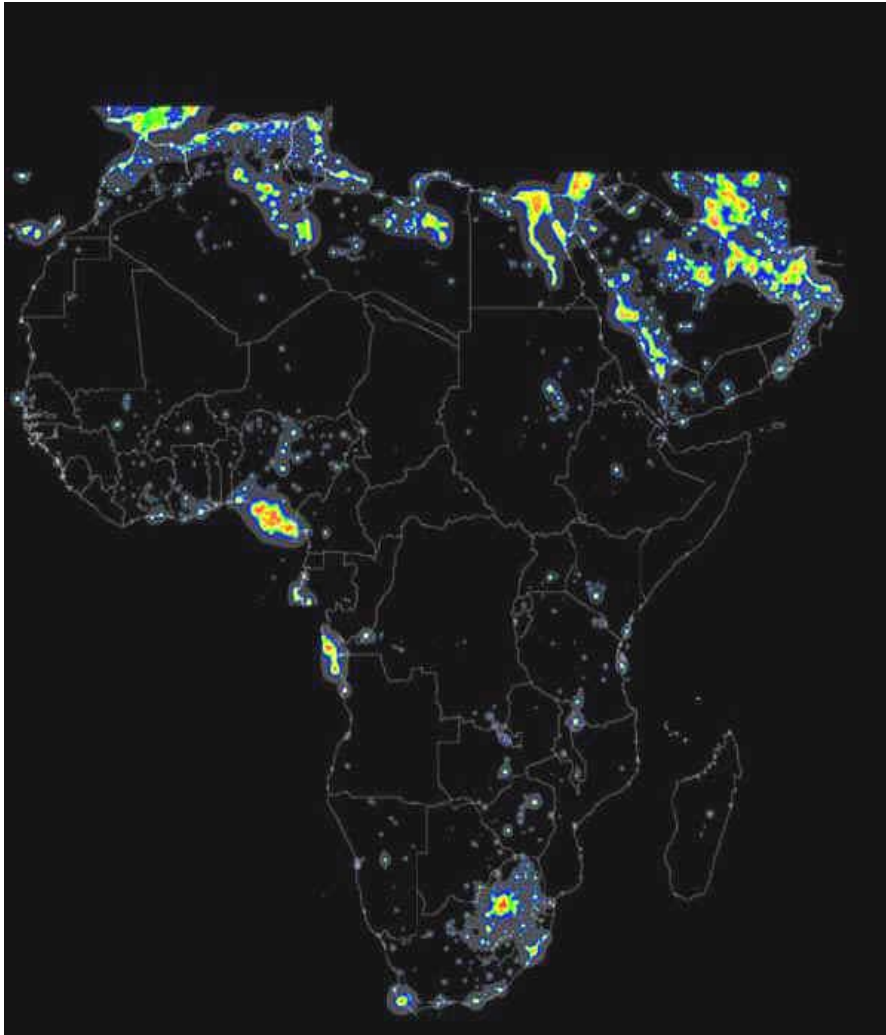# Carbon-Nickel Oxide Nanocomposites: Preparation and charecterisation

Ngcali Tile[1,2], Kittessa Roro[1], Andrew Forbes[1,2]
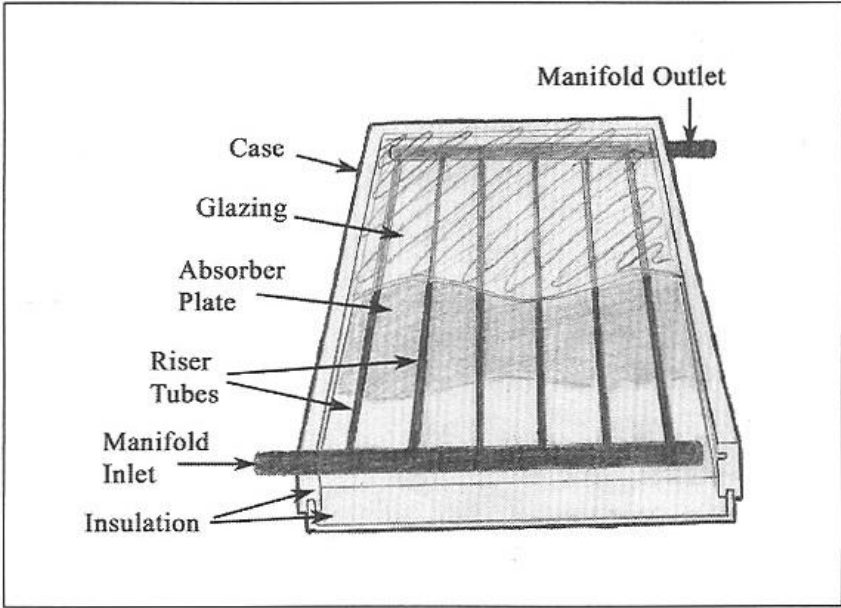
[1] CSIR National Laser Centre, Pretoria

[2] School of physics, university of KwaZulu-Natal, Durban

CSIR

our future through science

Energy delivery is still lacking in most rural Africa

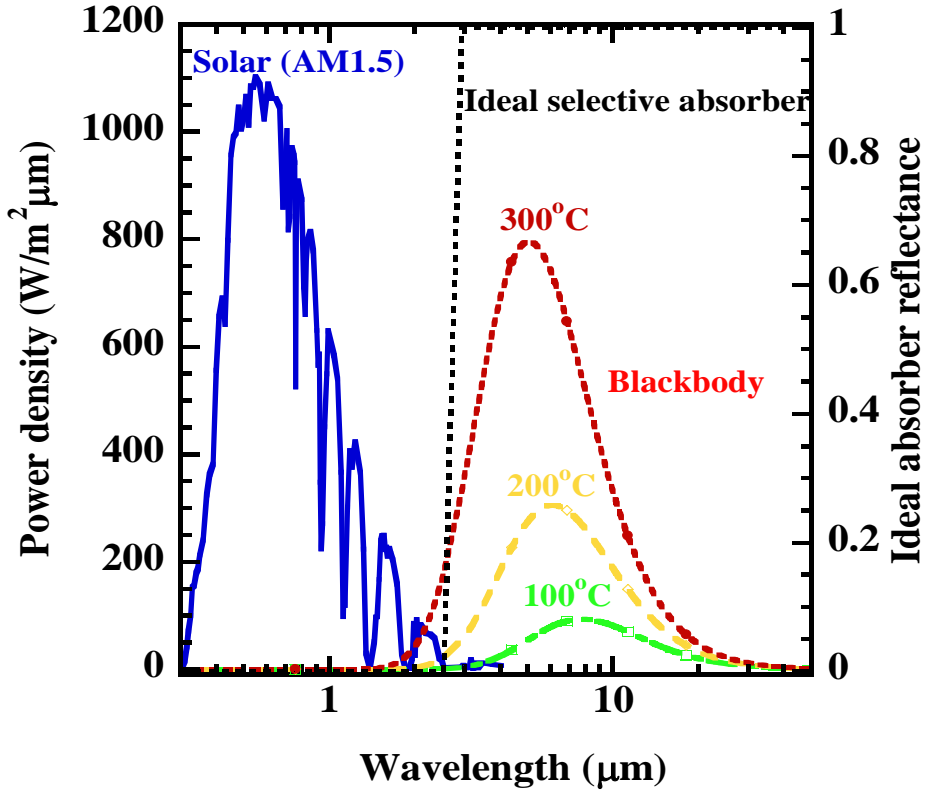# Solar thermal technology is used for harnessing solar energy for water heating applications

Manifold Outlet

Case

Glazing

Absorber Plate

Riser Tubes

Manifold Inlet

Insulation

Absorber material

Reflective and thermally conducting metal

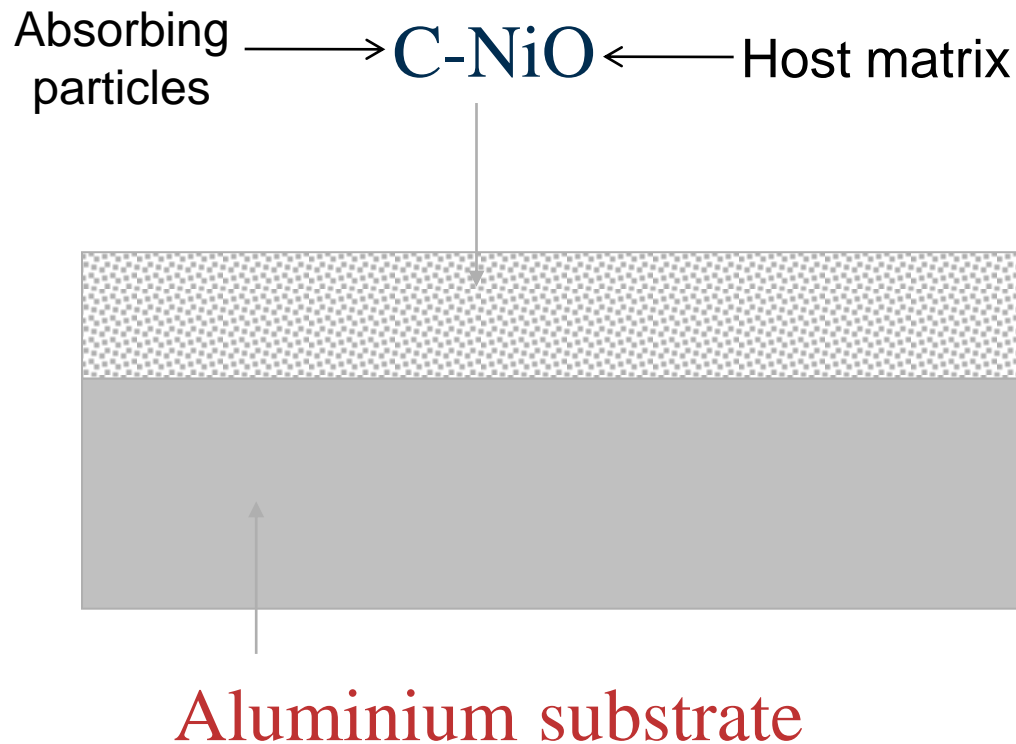# Spectrally selective surface have high solar absorptance accompanied by low thermal emittance
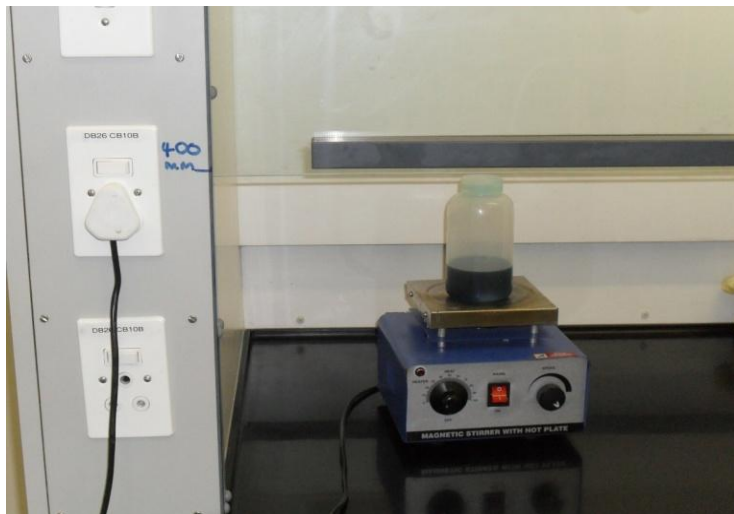

$$\alpha_\lambda = \varepsilon_\lambda = 1 - R_\lambda$$

$$\alpha_{sol} = \frac{\int\limits_{0.3}^{2.5} I_{sol}(\lambda)(1 - R(\lambda))d\lambda}{\int\limits_{0.3}^{2.5} I_{sol}(\lambda)d\lambda}$$

$$\varepsilon_{therm} = \frac{\int\limits_{2.5}^{20} I_P(\lambda)(1 - R(\lambda))d\lambda}{\int\limits_{2.5}^{20} I_P(\lambda)d\lambda}$$

C-NiO composite studied as a candidate spectrally selective material

Absorbing particles ⟶ C-NiO ⟵ Host matrix

Aluminium substrate

G. Katumba *et al*. Sol.Energy Mater. Sol.Cells 92 (2008) 1285–1292
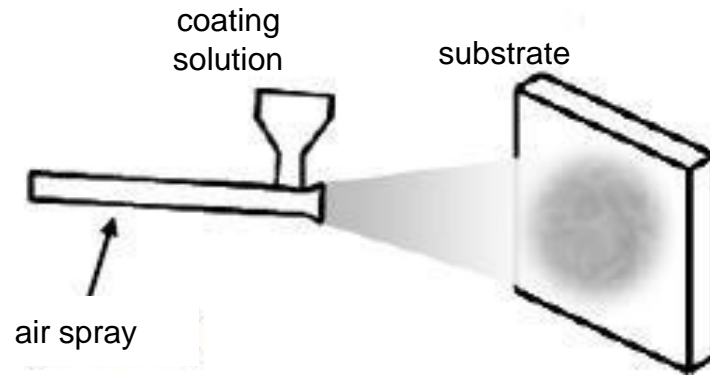
Samples were fabricated in 3 simple steps

Sol-gel technique can be adapted to different coating methods
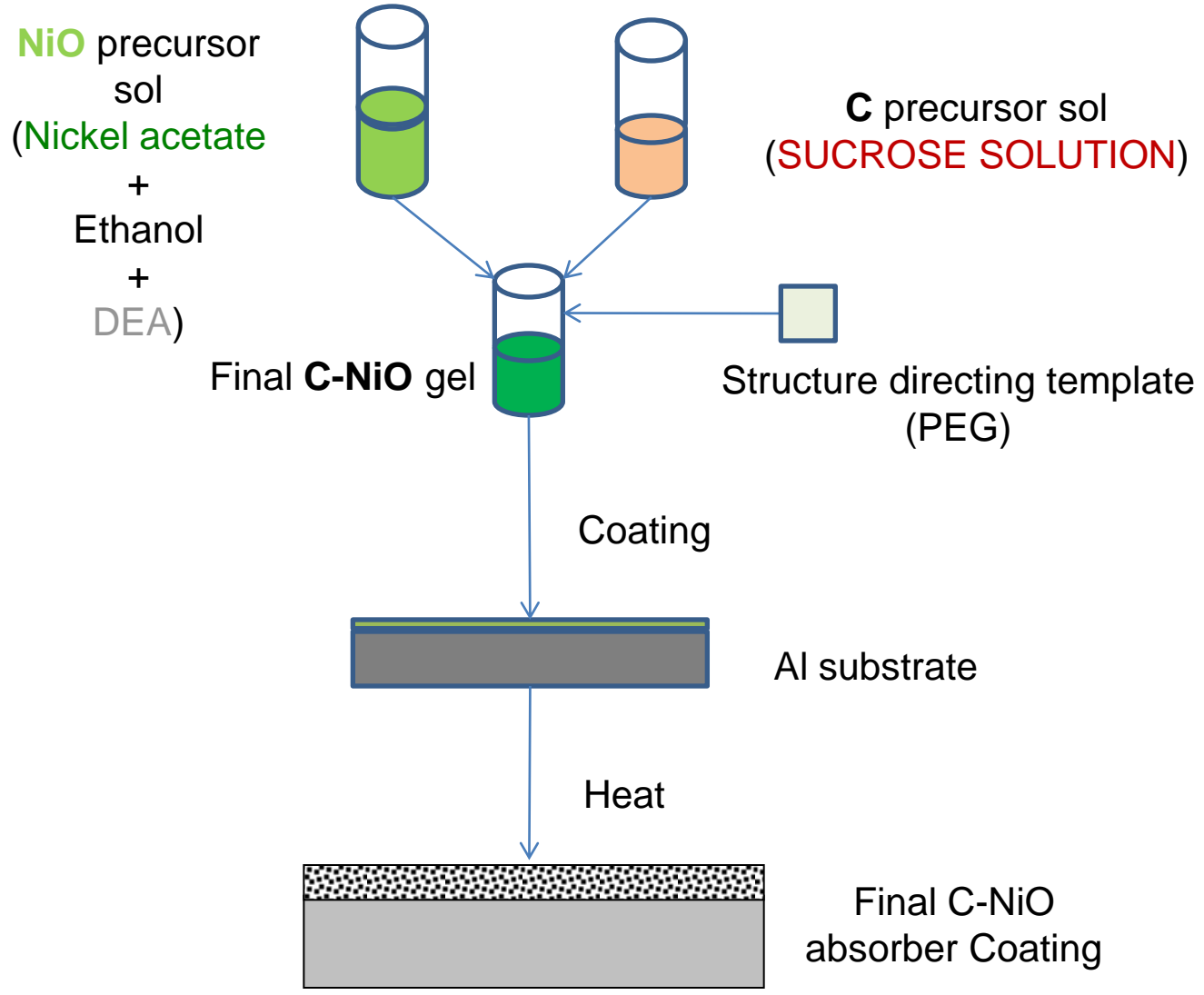
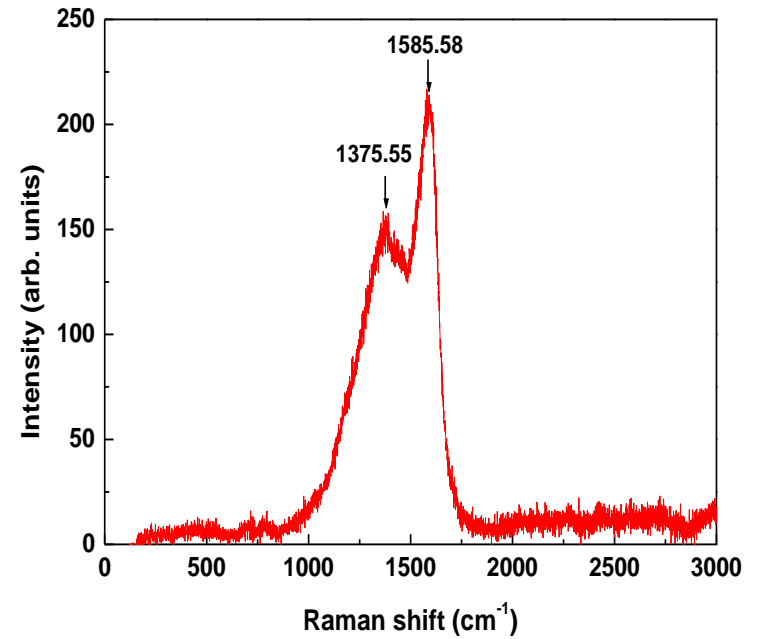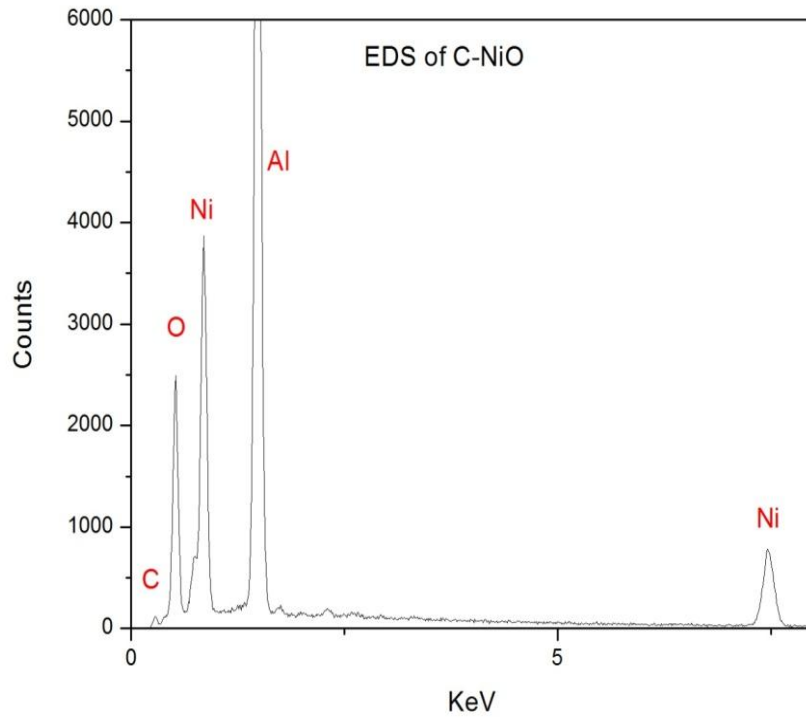

Spin coating

coating solution

substrate

air spray

Spray coating

By suitable choice of precursors, we can fabricate composite materials

NiO precursor sol
(Nickel acetate
+
Ethanol
+
DEA)

C precursor sol
(SUCROSE SOLUTION)

Final **C-NiO** gel

Structure directing template
(PEG)

Coating
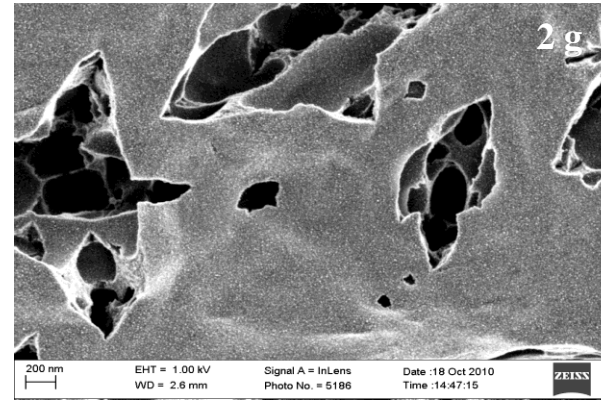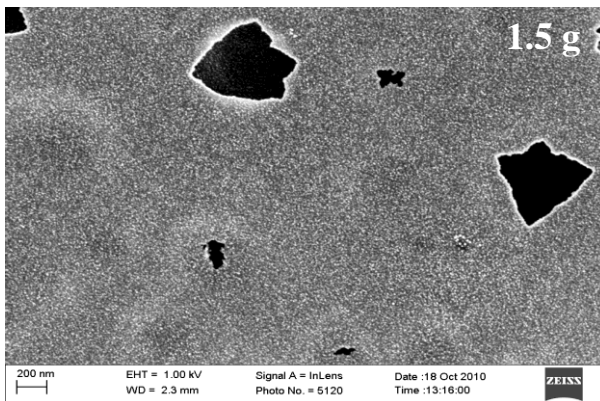
Al substrate
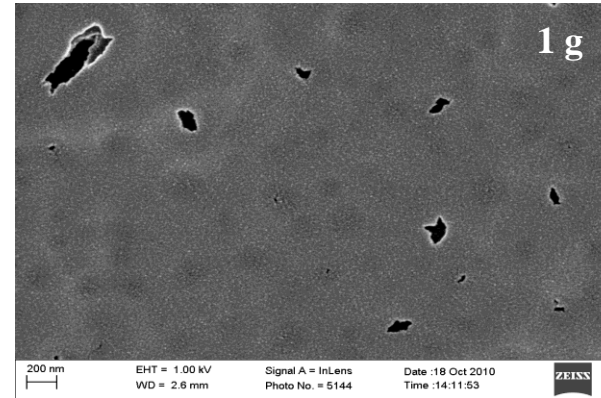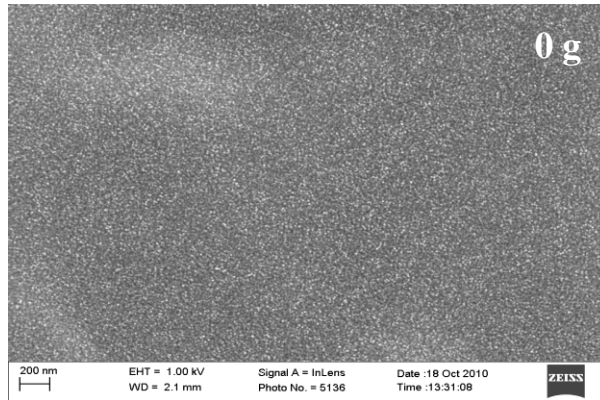
Heat

Final C-NiO
absorber Coating

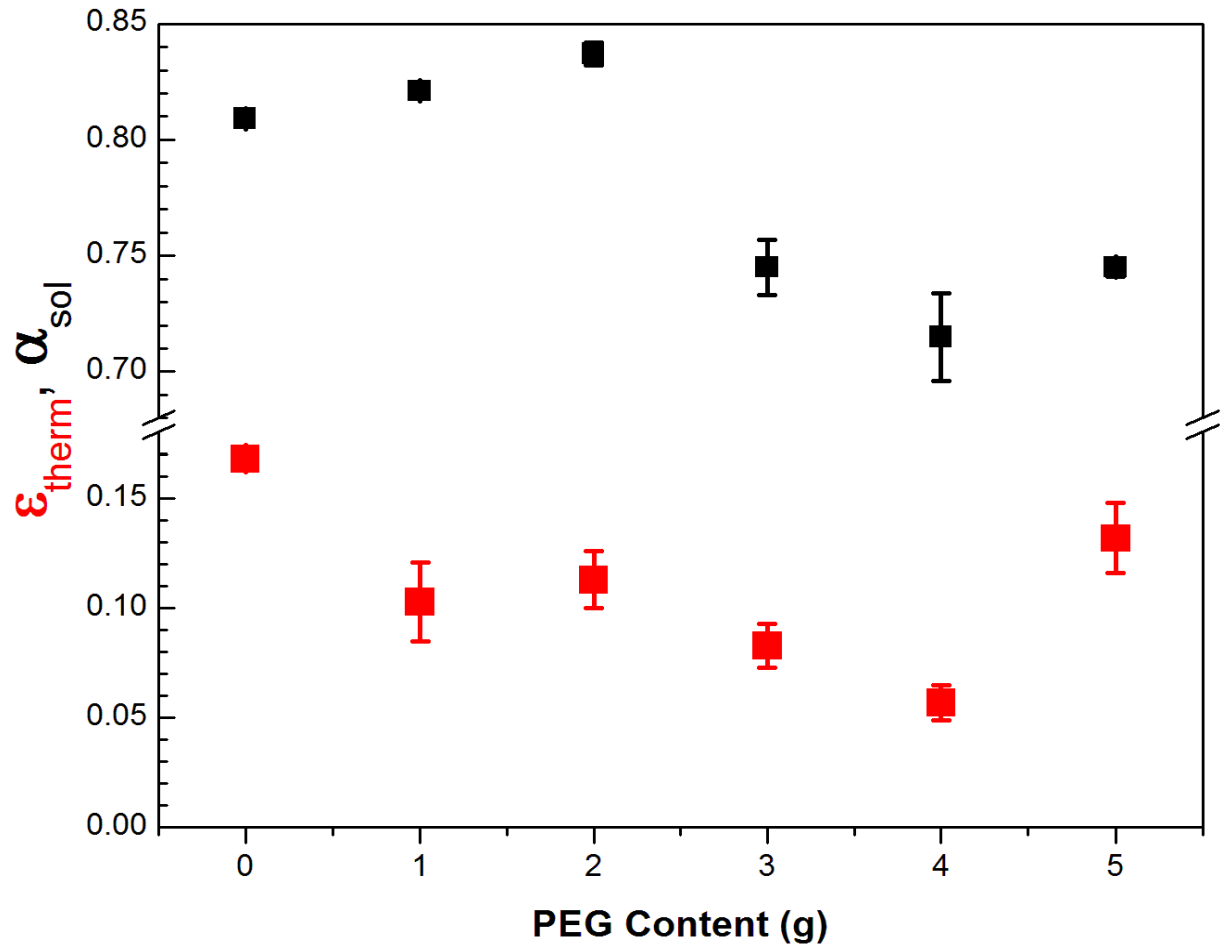# EDS confirms NiO while Raman reveals a presence of predominantly graphite Carbon

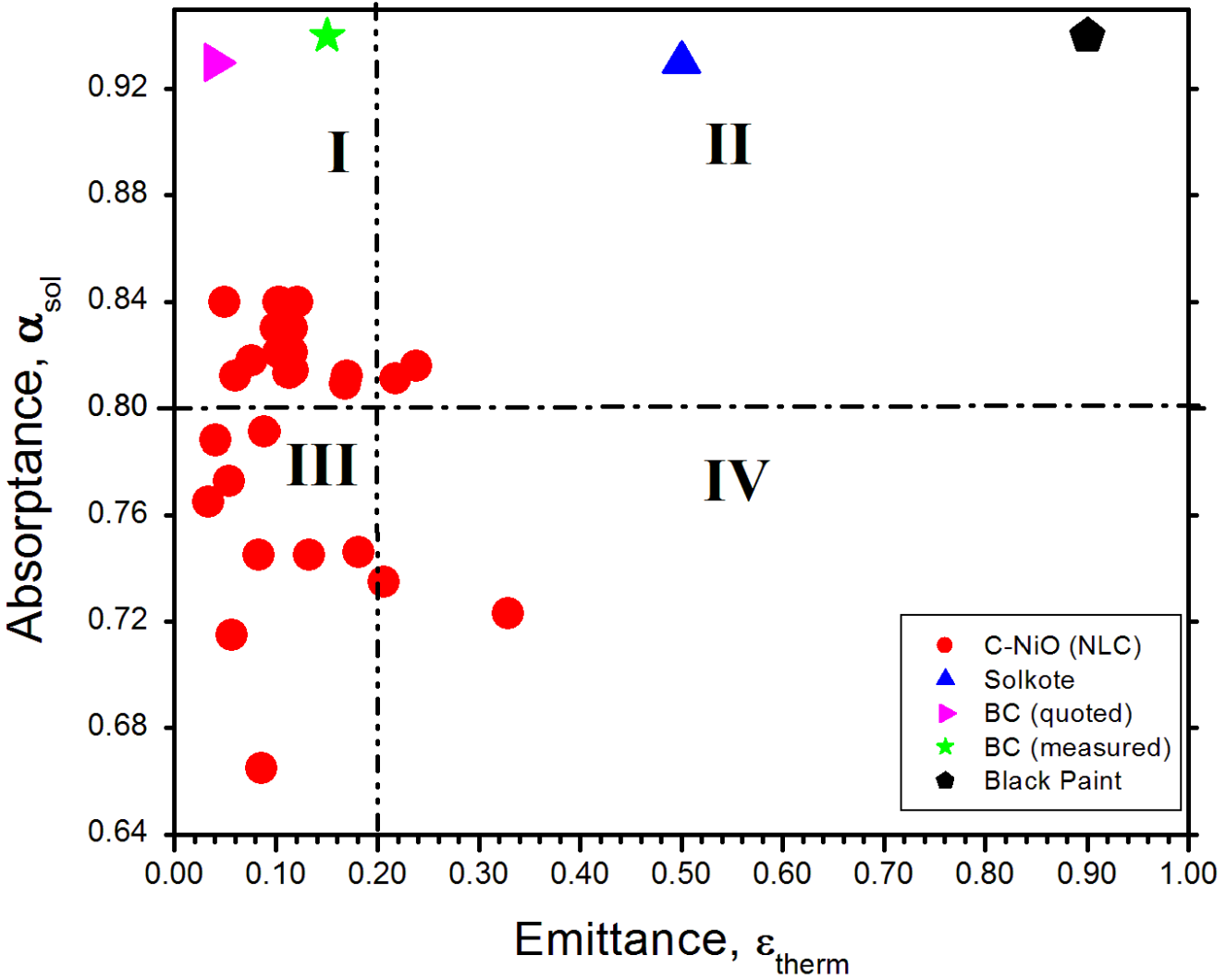# Selectivity improves with an increase in heat treatment temperature
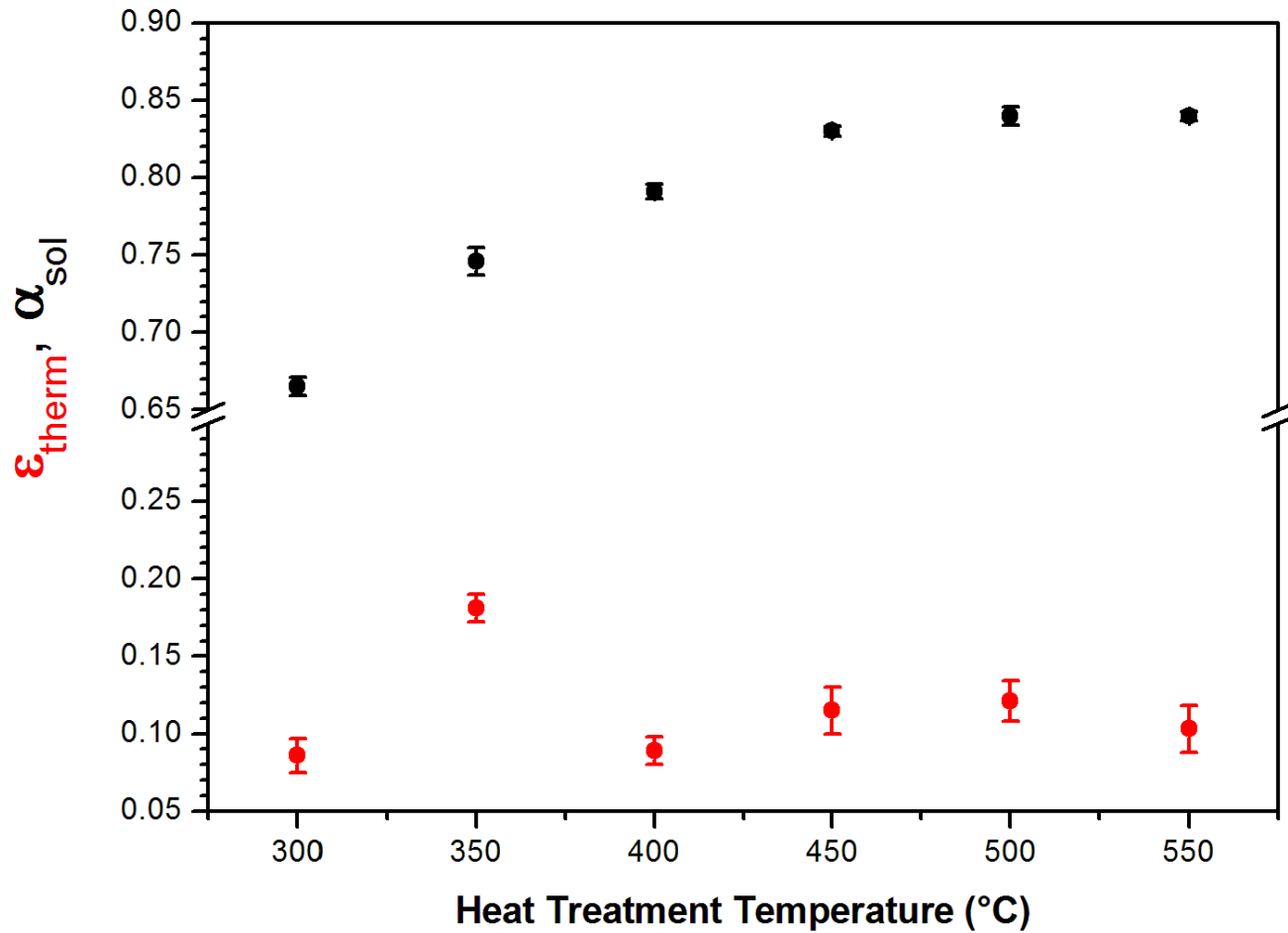
PEG affects the porosity of the films
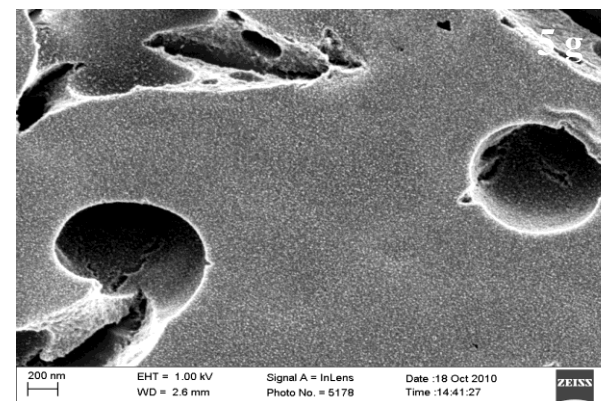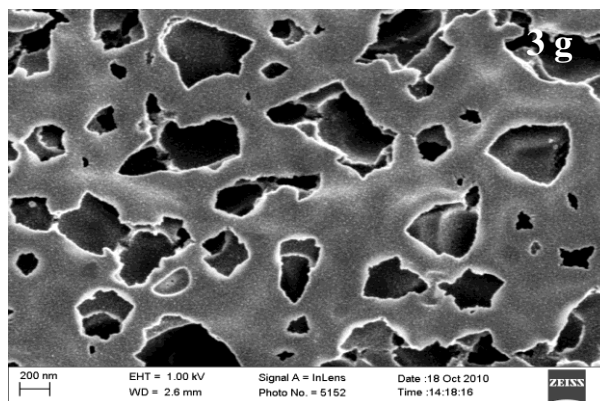
Absorption properties vary with PEG content peaking at 2 grams

Summary of the most important results

The cost of our coating is relatively cheap

Coating	Cost/m^2 Lab scale	Cost/m^2 Large scale
C-NiO	R 14.50	R 0.65
Solkote	-	R 12
Black Paint	-	R 4
Black Chrome	-	R 20
Nickel-Alumina	-	R 1.50

Thank You