SYNTHESIS AND OPTICAL CHARACTERISATION OF C-SiO_2 AND C-NiO SOL-GEL COMPOSITE FILMS FOR USE AS SELECTIVE SOLAR ABSORBERS.

BY

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DECLARATION

This thesis is my original work and has not been submitted for examination in any other University.

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ABSTRACT

Carbon-silica (C-SiO_2) and carbon-nickel oxide (C-NiO) composite films were fabricated on aluminium and steel substrates by the sol-gel technique. The substrates were cleaned before spin coating took place. The precursor for carbon was sucrose, that for silica was tetraethyl orthosilicate (TEOS) and that for NiO was nickel acetate. The precursor sols were prepared and used to spin coat the cleaned substrates. Coated substrates were heat treated to carbonise them at different temperatures.

Optical measurements were performed using a LISR-3101 UV/Vis/NIR spectrophotometer and an M500 IR spectrophotometer to determine solar absorptance and thermal emittance of each sample. The overall goal was to obtain efficient solar absorbers by optimising the optical properties.

The effects of polyethylene glycol (PEG) content, sucrose (SUC) content and spin coating speed on the optical characteristics were investigated for C-NiO samples. Addition of PEG resulted in an increase in both the absorptance and emittance. The experiments showed that increasing SUC content increases the absorptance and lowers the emittance. The absorptance was found to increase with spin coating speed.

The results for C-NiO samples show that the limit for absorptance is 0.94 and that for the emittance is 0.12. The optimum figures achieved in a single C-NiO sample are 0.63 for absorptance and 0.11 for emittance.

The results for C-SiO_2 samples show that the limit for absorptance is 0.95 and that for the emittance is 0.55. The optimum figures achieved in a single C-SiO_2 sample are 0.93 and 0.56.

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