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THE DEVELOPMENT OF SELECTIVE SURFACES OF Ni-NiO BY MAGNETRON SPUTTERING FOR PHOTOTHERMAL APPLICATIONS

G. R. Guimarães[1,2], W. Sade[1], J. R. T. Branco[2],

[1] *REDEMAT(UFOP, CETEC, UEMG), Ouro Preto, MG, Brazil.*

[2] *Fundação Centro Tecnológico de Minas Gerais - LEMS, Belo Horizonte/MG, Brzil.*

Abstract – Solar energy has become one of the main alternatives for sustainable energy supply. To improve the efficiency of thermosolar collectors the development of selective surfaces has high priority. Among materials, graded Ni-NiO composites is one that has provided relevant results. Ni/NiO duplex layer on aluminum substrate have been prepared and characterized for flat solar collector application. The duplex selective surface was prepared by reactively magnetron sputtering Ni targets under different conditions. The samples were examined by X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), UV-Vis and FTIR spectrophotometer.

It's important for the environment conservation discover new ways to produce energy or improve the existent ways. These developments have to be renewable, Energy-efficient and clean. Because of this concern we developed selective surfaces of Ni/Nio for solar absorbers.

Ni/NiO duplex layers were prepared by reactive physical vapor deposition, aiming usual quality requirements [1] using DC magnetron sputtering, the first layer being Ni and the second one an anti-reflection layer of NiO. Magnetron sputtering was chosen for its strength on industrial scale [2], easiness to automate and to control gradient structures profiles and thickness.

The coatings were prepared at pressure relatively standard for sputtering, in atmosphere with different ratios of, Argon and Oxygen. The deposition time for Ni and NiO varied between 10 and 90 min and temperature were kept bellow 100C.

The samples were examined by X-Ray Diffraction (XRD), Scanning Electric Microscopy (SEM) and Atomic Force Microscopy (AFM) and will be examined by Electron Auger and XPS. The solar absorptance (*α)* was calculated from the measures of reflectance in Uv-Vis spectrophotometer and the thermal emitter (*ε)* form measurements of reflectance in Fourier Transformed Infrared spectrophotometer (FTIR).

The films have duplex structure and are mainly crystalline with composition, thickness and optical properties as shown in the Table 1.

Table 1 -Percentage of Ni and NiO, film thickness, solar absorption, thermal emittance of the samples.

Sample	*Ni (%)*	*NiO (%)*	Thickness (nm)	*α (%)*	*ε(%)*	*α/ε*
A	54,2 ± 5,2	45,8 ± 5,2	1.190 ± 115	99,2 ± 0,2	9,4 ± 1,1	10,4
B	68,7 ± 5,7	31,3 ± 8,6	244 ± 19	98,0 ± 0,6	25,0 ± 2,0	3,9
C	65,4 ± 7,3	34,6 ± 7,3	1.850 ± 153	99,1 ± 0,3	19,0 ± 0,8	5,2
D	64,9 ± 8,6	35,1 ± 5,7	233 ±18	99,0 ± 0,4	12,3 ± 0,9	7,5
E	51,5 ± 4,1	48,5 ± 4,1	360 ± 21	98,1 ± 0,9	10,7 ± 0,3	9,0

References

[1] BOSTRÖM, T. K., WÄCKELGARD, E. G. W., Anti-re.ection coatings for solution-chemically derived nickel-alumina solar absorbers, *Solar Energy Materials & Solar Cells* , 84 (2004) 183–191.

[2]KENNEDY, C.E., *Review of Mid-to-High Temperature Solar Selective Absorber Materials*, NREL, Colorado, U.S., July 2002.