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Linking Optical Properties and Nanostructure of NiCrOx Cermet Nanocomposite for Solar Thermal Application

Lucie Gaouyat, Z. He, Jean-François Colomer, D. Schryvers, F. Mirabella, and Olivier Deparis

Abstract Conversion of solar energy into thermal energy helps reducing consumption of non-renewable energies. Cermets (ceramic-metal composites) are versatile materials suitable, amongst other applications, for solar selective absorbers. The presence of metallic Ni nanoparticles (NPs) in the dielectric matrix is a prerequisite for efficient solar selective absorption in NiCrOx cermets (Zhao and Wackelgard, Solar Energy Mater Solar Cells 90:1861–1874, 2006). By combining comprehensive chemical and structural analyses, but also electronic microscopy, we revealed the origin of the remarkable optical properties of this cermet material. A solar absorber multilayer stack on aluminium substrate using a sputtered NiCrOx layers allows us to achieve solar absorptance as high as $\alpha = 96.1\,\%$ while keeping thermal emissivity as low as $\epsilon = 2.2\,\%$ both values are comparable to best values recorded so far (Buhrman, Physics of solar selective surfaces. In: Ber (ed) Advances in solar energy. Springer, New York, pp 207–282, 1986). Determining the origin of sputtered NiCrOx cermets optical properties drives further optimization of solar absorbers.

L. Gaouyat (✉) • J.-F. Colomer • O. Deparis
Department of Physics, University of Namur, rue de Bruxelles, 61, B-5000, Namur, Belgium
e-mail: lucie.gaouyat@unamur.be

Z. He • D. Schryvers
Electron Microscopy for Materials Research (EMAT), University of Antwerp, Groenenborgerlaan 171, Antwerp B-2020, Belgium

F. Mirabella
CRM Group AC&CS, Boulevard de Colonster 57B, Liege B-4000, Belgium

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