Characterization of black chrome films in the presence and absence of graphite encapsulated FeCo nanoparticles prepared by electrodeposition technique for solar thermal applications

Belal Usmani[a] and S. Harinipriya[a]*

[a]Center of excellence in Energy, Indian Institute of Technology, Jodhpur, Rajasthan, India, 342011

Abstract

The surface and thermal properties of black chrome films prepared by electrochemical bath were characterized. The black chrome films have been deposited on Copper and nickel coated copper substrates by electrodeposition technique. Electrodeposition was done in the presence of three different weight proportions of graphite encapsulated FeCo nanoparticles such as 0.025, 0.05 and 0.1 to the electrolyte bath. The surface morphology and thermal analysis of the films were investigated by using scanning electron microscopy (SEM) and Simultaneous Thermal Analyser, respectively. The chemical composition of prepared films was determined by energy-dispersive x-ray analysis (EDS). From the SEM analysis, it was found that prepared films were porous, with micro sized grains and after electrochemical treatment in 3.5% NaCl became denser with nano size grains. The Tafel results show that in both cases chrome is the main chemical component in the films. The films prepared on bare copper have better thermal properties than the films prepared on nickel coated copper substrates. The thermal stability increased upto 600^0C in the presence of 0.05 weight percentage of graphite encapsulated FeCo nanoparticles in Nitrogen atmosphere and paves way for the future utilization of the black chrome coatings in concentrated solar power receivers like parabolic trough.

Key words: Black chrome, electrodeposition, parabolic trough, graphite encapsulated FeCo nanoparticles

Corresponding Author Email: shpriya@iitj.ac.in