Study of the Novel Ni/Co–SiC Coatings Deposited by Pulse Current Electrodeposition. Influence of the Pulse Frequency and the Duty Cycle

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Ni/Co–SiC coatings were successfully deposited on mild steel via pulse current electrodeposition (PCE) technique. The impact of the frequency and duty cycle on the coating characteristics, such as surface morphology, the orientation of grains, crystal size, micro-hardness, the amount of deposited SiC CNPs, as well as corrosion resistance, were ascertained and discussed. The results indicate that the SiC particles tend to agglomerate, leading to the formation of particle clouds, having mean dimensions of approximately 116.1 nm, enveloped as second phases in the matrix of Ni/Co coating. The Ni/Co–SiC coating created at a duty cycle of 10% and 10 Hz pulse frequency was able to process the maximal SiC content equivalent to 11.5 v/v%. It also illustrates that, with the increment in pulse frequency or decrease in duty cycle, the coating grain assumes a smaller size. The Ni/Co–SiC coating synthesized at a duty cycle of 10% and 10 Hz pulse frequency manifest the maximum micro-hardness value of 672.5 kg/mm, and the Ni/Co–SiC coating deposited at 20 Hz and 30% has the maximum micro-hardness value of 642.2 kg/mm. In addition, the resistance of charge-transfer at the electrode/solution is known to affect the size of the semicircle, hence the size increases with the increment in pulse frequency and decrease in duty cycle.

Keywords: Ni/Co–SiC coating; pulse frequency; duty cycle; surface morphology; corrosion resistance

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