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Uniform Fine Particles of ZrO_2 as Reinforcement Filler in the Electrodeposited Cu-ZrO_2 Nanocomposite Coating on Steel Substrate

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Abstract

Monodispersed spherical particles of ZrO_2 were synthesized in an aqueous medium by homogeneous precipitation without being using any capping agent. Results revealed that size and uniformity of the synthesized particles were greatly dependent upon the experimental conditions. SEM, XRD, and FT-IR were used for characterization of selected particle systems. SEM analysis showed the spherical morphology of the as-prepared particles, which remained unchanged even after calcination at 750 ^oC. XRD results presented poor crystalline nature of the as-prepared solid while the calcined solid was perfectly crystalline. Furthermore, Cu-ZrO_2 Nanocomposite coatings, containing variable amounts of the incorporated ZrO_2 nanoparticles were deposited on a steel substrate by the electrodeposition from a dispersion of ZrO_2 particles in aqueous solutions composed of copper sulfate, boric acid, and sulfuric acid. Effect of ZrO_2 concentration in the plating bath applied current and stirring rate of the coating mixture on the co-deposited ZrO_2 particles in the composite coatings were evaluated. It was noted that these parameters had noticeable effect on the particles content of the composite coatings. The deposited composite coatings were analyzed for their surface morphology and microhardness respectively by scanning electron microscope and microhardness tester. Similarly, wear resistance of the coated samples was determined by using Ball-On-Disc Tribometer, attached to data acquisition system for continuous monitoring of friction force at the sliding contacts. Selected batches of the coated substrates were tested for their response to corrosion tests at room temperature. It was observed that the amount of the embedded ZrO_2 particles in the composite coatings affected the cathodic polarization potential of the test samples. Conclusively, amount of the dispersed ZrO_2 particles in the copper matrix turned out to be the key parameter in controlling the properties of the composite coatings.

***Keywords*:** Zirconia; monodispersed; metal-matrix nanocomposites; corrosion resistance; friction coefficient.