ELECTRODEPOSITION OF NANOCRYSTALLINE ZINC

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ABSTRACT

Nanocrystalline materials exhibit properties that are fundamentally different from, and often superior to, those of the conventional polycrystalline counterparts. Zinc has been the most widely used electrodeposit for protection of steel against corrosion. Surface morphology, preferred orientation, and grain size have a significant effect on the mechanical properties of zinc electrodeposits. The role of surface morphology and preferred orientation on mechanical properties of zinc electrodeposits remains unclear [1]. However, it has been known that almost all of the mechanical properties can be effectively improved by refining the grain size. This is one reason nanocrystalline materials have recently received considerable attention [2]. Accordingly, many efforts have been made by researchers in order to refine the grain size of zinc coatings and improve their properties [3]. So far, the grain size of the electrodeposited zinc coatings is in the micrometer or sub-micrometer range. Therefore, the main goal of this work is to produce nanocrystalline (nc) zinc coatings and characterize their mechanical properties according to their grain size, surface morphology, and preferred orientation.

Electrodeposition is used to produce nc zinc coatings. The effect of additives and current waveform on the grain size and surface morphology of zinc deposits is studied by SEM, FESEM, and AFM. The preferred orientation of zinc deposits is studied by x-ray diffraction. Also, microhardness of the deposits is measured by a Knoop microhardness tester. We report the results of these studies and discuss their implications.

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