

Fabrication and Characterization of Cu₅₀ (Zr_{50-x}Ni_x)₅₀ Nanocrystalline Coating by Cold Spray Technique for Potential Antibiofilm Application

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Abstract : Arc melting technique followed by top-down approach, using a high-energy ball milling technique were employed to synthesize nanocrystalline of Cu₅₀(Zr_{50-x}Ni_x)₅₀ (x = 0, 10, 20 and 30 at.%) powder particles. The end-products of the alloy powders obtained after 50 h of the ball milling time were uniform in composition and had spherical-like morphology with an average particle size of 0.75 μm in diameter. The powders, which consisted of nanocrystalline grains with an average grain size of 10 nm in diameter, were used as feedstock materials for double face coating of stainless (SUS304) sheets, using cold spraying process. The coating materials enjoyed nanocrystalline structure and uniform composition. Biofilms were grown on 20-mm² SUS304 sheets coated coupons inoculated with 1.5 × 10⁸ CFU ml⁻¹ E. coli. Significant biofilm inhibition was recorded in the nanoparticles coated coupons in comparison to non-coated SUS304 coupon. In conclusion, this study demonstrates that formation of biofilms can be significantly inhibited by Cu-based alloys especially in case of high (Ni) content. The inhibition of biofilm formation by nanocrystalline powders of Cu-based provides a practical approach to achieve the inhibition of biofilms formed by an emerging pathogen.

Keywords : biofilm, Cu, E.coli, FE-HRTEM/EDS, nanomaterials, nanocrystalline

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