

Developing an Enhanced of Nickel-Chrome/Chrome-Carbide Coating for Railroad Steel by Cold Spray Technology

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Steel is an essential material in high load bearing applications such as railroads. It is preferred over other metals due to its relatively low cost, good strength, durability, and corrosion resistance. However, steel too is prone to damage over time due to environmental conditions and loading. Metal matrix composite (MMC) coatings can enhance the durability and performance of steel members under high loads and harsh environments. In this work cold spray (CS) technology is used to apply MMC coatings over steel. While CS offer many advantages, such as minimal thermal input and dense coatings, it can also produce coatings with reduced ductility. Nickel-chrome/chromium-carbide (CrC-NiCr) coatings with varying metal to ceramics weight percentages were cold sprayed onto A-514 steel to investigate the effect of annealing temperature and metallic phase differences on the coating's microstructure, microhardness, ultimate tensile strength, shear strength, and elongation percentages. Results indicate that increasing the percentage of ceramics particles in the feedstock powder results in a coating with a higher ceramics area fraction percentage. In addition, higher annealing temperatures enhance matrix interparticle adhesion, ductility, shear, and tensile strength. whereas reduces the microhardness.