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Framework for effective automobile operations using cold spray technology

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2019
https://hdl.handle.net/10539/28421

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ABSTRACT

Cold spray technology is an additive manufacturing technology characterised by small particles being deposited onto a substrate at high velocity using a supersonic gas jet. It has been shown to provide quality coatings for repairs, dimensional restoration, corrosion protection and fabrication of components in different industries. Cold spray technology does not induce any thermal stress on the substrate, thus ensuring the material properties of the substrate are conserved. This advantage has enabled deposition on unconventional materials such as ceramics, polymers and composites as well as metals such as aluminium and magnesium, which are critical to the automotive industry. Traditional coating and repair processes have not been able to adequately coat these materials without introducing deleterious defects onto the substrate. As a result, parts are required to be replaced at a considerable cost with longer lead times. Cold spray technology enables the recovery of these units in production, thus ensuring plant throughputs are attained.

The automotive industry's quest for Greener solutions that increase production, economies of scale and global penetration motivates the adoption of such technologies. Cold spray technology does not emit any harmful greenhouse gases and diminishes all emissions associated with the primary extraction of minerals and vehicle production. Furthermore, the industry has a growing demand for lightweight vehicles to achieve fuel efficiency and better emission control. The ability of cold spray technology's to coat unconventional materials enables substitution of traditional cast iron and mild steel with lightweight alternatives such as magnesium and aluminium. Development of new materials with advanced properties and functionalities means cold spray coatings can grow existing profit avenues and open new ones for the automotive industry. The technology enables on-demand, on-time delivery of components that match customer demands and customisation through additive manufacturing.

In this dissertation, different cold spray technology research and development opportunities are reviewed and consideration of their efficient operations within the South African automotive industry is established and evaluated. The findings demonstrate the ability of cold spray technology to fabricate, protect and rework different substrates critical to the automotive industry. Based on the findings, it is suggested that the industry foster collaborative efforts within and out of the industry.