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Improving properties of AZ31 magnesium alloy surface layer by HVOF sprayed WC - based coatings

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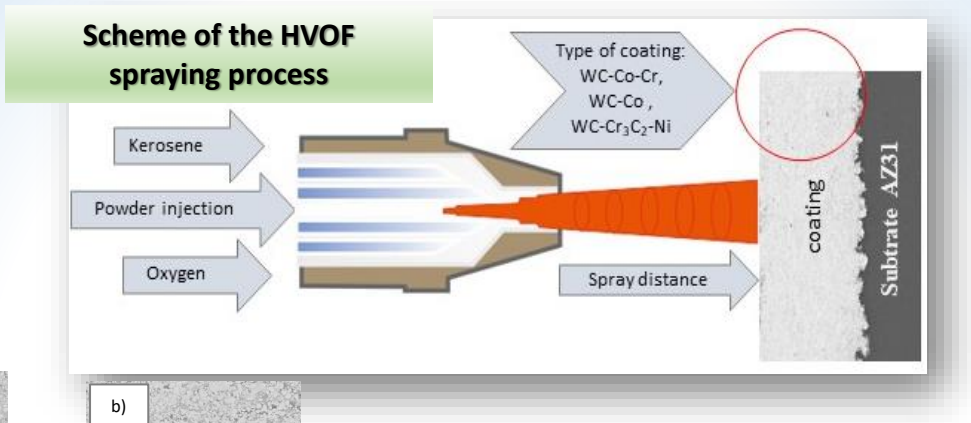
The aim of the presented innovation is to develop a method of manufacturing hard coatings using High Velocity Oxy Fuel method (HVOF) on a soft substrate of magnesium alloy, which will allow the use of light components (Mg alloy) covered with coatings resistant to abrasion and corrosion and will enable the introduction of such a solution in the industry. In the present work three types of cermet coatings manufactured from commercially available WC-based powders (WC-Co-Cr, WC-Co and WC-Cr_3C_2-Ni) onto AZ31 substrate was to compare in terms of their microstructure features (using scanning electron microscope, SEM), topography (confocal microscope), hardness (Vickers indenter), instrumented indentation (NHT3 nanoindenter) and instrumental Young modulus (calculated from slope of unloading curves for indents with different maximum loads) respectively.



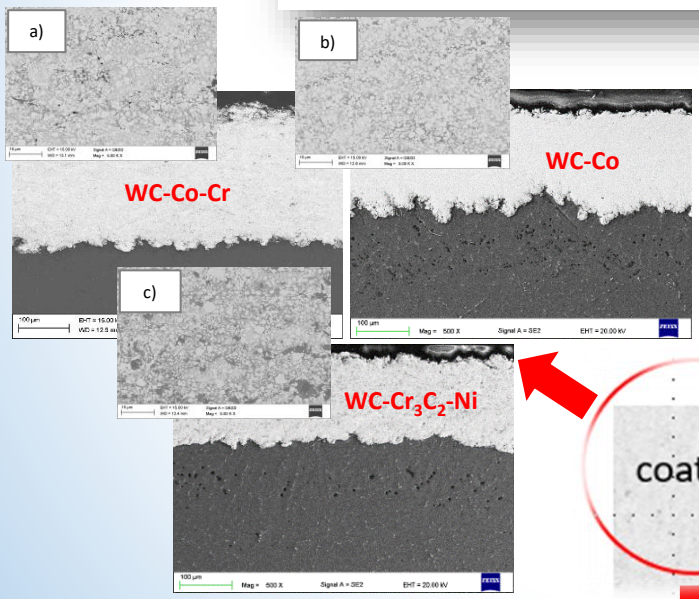


Figure 1. Cross-section and microstructure of manufactured coatings: a) WC-Co-Cr, b) WC-Co, c) WC-Cr_3C_2 -Ni

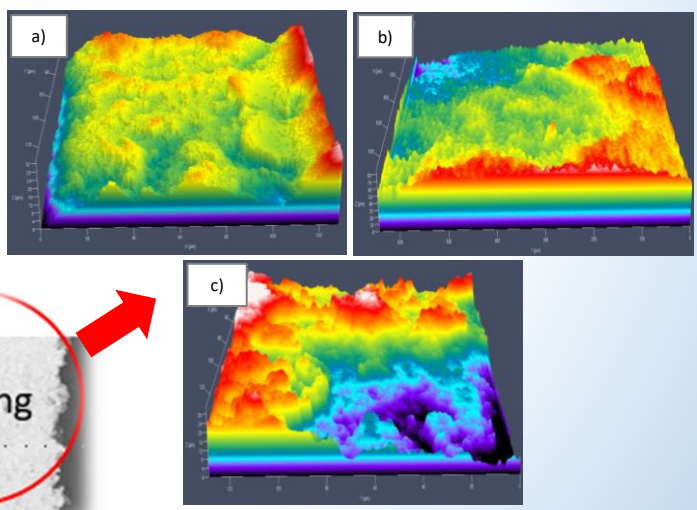


Figure 2. The topography of manufactured coatings: a) WC-Co-Cr, b) WC-Co, c) WC-Cr_3C_2 -Ni

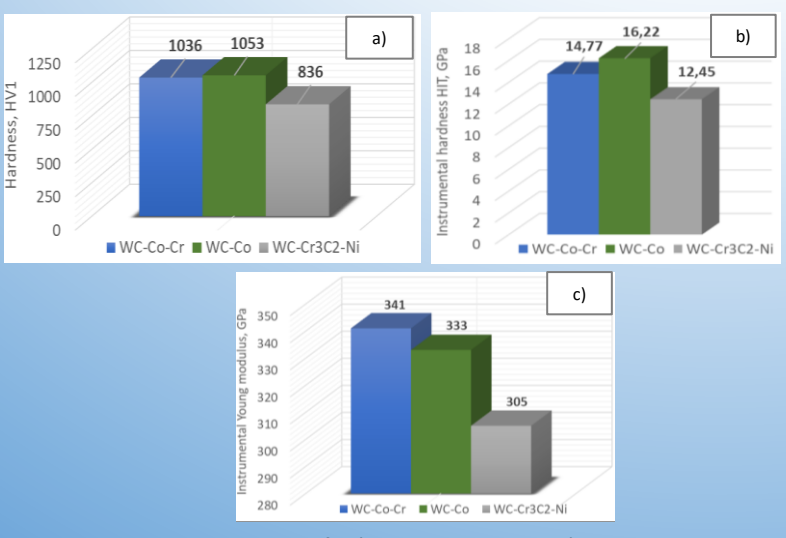


Figure 3. Comparison of: a) hardness HV1, b) instrumental hardness HIT, c) instrumental Young modulus EIT

Conclusion

All the coatings have been successfully deposited, the coating-substrate interface is clear, without discontinuities and the coatings revealed relatively smooth, dense and homogeneous structure. The hardness and instrumental hardness measurements showed the same tendency, moreover, they confirmed that coatings based on cobalt matrix exhibit higher hardness and Young modulus than ones based on nickel matrix. Selected process parameters made it possible to obtain well-adhered coating with good fulfillment of the surface unevenness of the AZ31 substrate.

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