# Investigations of solid particle erosion resistance of WC - based coatings deposited by HVOF on to Mg alloys substrate

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## Abstract

**Statement of the Problem:** Magnesium alloys have been the focus of study for a number of years in academic institutions and research institutes, as well as among manufacturers in the automotive, machine building, shipbuilding, aviation, chemical, energy, and textile sectors.

These alloys have the best density of any currently available building material (1.5–1.8 g/cm$^3$) and a high strength to weight ratio, which allow them to be considered the building material of the future. However, their limited resistance to abrasive wear, corrosion, and erosion can negatively impact and restrict their broad use.

The solution to this problem is to deposit a protective layer, including through thermal application coatings. Thermal spraying processes could extend the durability and service life of new machine parts and recycle. Depending on the type of heat source used to melt the coating material, spray the differences are: flame (low and high speed), explosion, arc and plasma, source material can be in powder or wire form. The most common of the above methods are High Velocity Oxy Fuel (HVOF) and Atmospheric Plasma Spray (APS). The HVOF process is capable of producing coatings with special properties including: low oxidation, very low porosity and high adhesion. An important advantage of this method is that the coating produced is highly wear-resistant and resistant to high temperatures, erosion and corrosion. The chemical composition of the feedstock is varied to produce coatings with specific properties for specific application.

**Conclusion & Significance:** The results of erosion test confirmed, that application of WC-based powders composite coatings: WC-Co, WC-Co-Cr and WC-$Cr_3C_2$Ni strongly improves resistance against eroded particles. The erosion craters are presented in Figure1. The main research goal of the current paper was to investigate the influence of a feedstock material type on the erosion resistance of the WC-12Co, WC-10Co-4Cr and WC-20$Cr_3C_2$-7Ni cermet coatings deposited on magnesium alloy substrate by HVOF method.

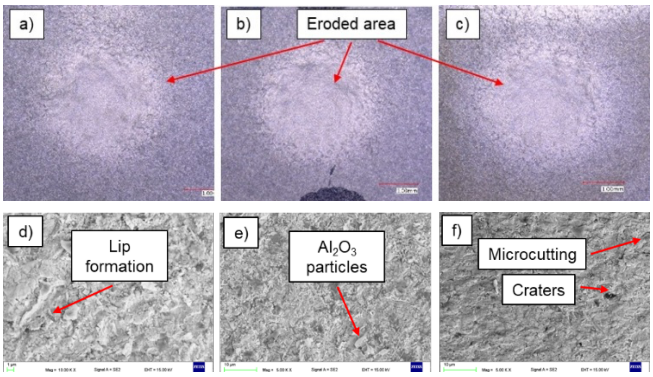


**Figure 1:** The general view micrographs of erosive craters for WC-Co (a), WC-Co-Cr (b) and WC-$Cr_3C_2$-Ni (c) coatings and detailed view (d,e,f) impact angle 90°

## Recent Publications

1. Liu B, Yang J, Zhang X, Yang Q, Zhang J, Li X., (2023) Development and application of magnesium alloy parts for automotive OEMs: A review. Journal of Magnesium and Alloys;11:15–47.
2. Jonda E., Szala M., Sroka M., Łatka L., Walczak M., Investigations of cavitation erosion and wear resistance of cermet coatings manufactured by HVOF spraying, (2023), Applied Surface Science, 608: 155071.
3. Morelli S., Rombolà G., Bolelli G., Lopresti M., Puddu P., Boccaleri E., et al., (2022), Hard ultralight systems by thermal spray deposition of WC-CoCr onto AZ31 magnesium alloy, Surface and Coatings Technology, 451:129056.
4. Matikainen V., Koivuluoto H., Vuoristo P., (2020), A study of $Cr_3C_2$-based HVOF- and HVAF-sprayed coatings: Abrasion, dry particle erosion and cavitation erosion resistance, Wear, 446-447: 203188.
5. Hejwowski, T. Modern Heat-Applied Coatings Resistant to Wear Abrasive and Erosive (2013) Lublin; Biblioteka Cyfrowa Politechniki Lubelskiej: Lublin, Poland; Available online: http://bc.pollub.pl/dlibra/publication/5141/edition/4059?language=pl(accessed on 15 June 2020) ISBN 978-83-63569-56-3.

Photograph

## Biography

Dr Ewa Jonda is the professor's assistant in the Department of Engineering Materials and Biomaterials, Silesian University of Technology, Poland and also a member of the Association Engineers and Technicians Polish Mechanics. The area of her scientific interests is related to materials engineering, in particular surface engineering, e.g. laser processing and thermal spraying. Mrs Jonda is also a reviewer and promoter of numerous scientific papers in the field of engineering of materials. She is also the author or co-author of many scientific articles and the winner of awards and medals for scientific achievements.

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