CIWC-2 2020
2nd Coatings and Interfaces Web Conference
15–31 May 2020
Chaired by Dr. Alessandro Lavacchi, Prof. Dr. Andriy Voronov

Preliminary studies on HVOF sprayed coatings on the magnesium alloys

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Plan of the presentation

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1. The goal of the research

In this work the results of the HVOF (High Velocity Oxygen Fuel) sprayed coatings deposited onto AZ31 magnesium alloy substrate have been presented. The feeding material was a composite powder Cr_3C_2 + 25 wt% NiCr. The coatings were investigated in terms of their microstructure and selected mechanical properties. For structure examinations the microscopy studies (light and scanning ones) were used as well as phase composition analysis. In case of mechanical properties, the wear resistance was determined and also microhardness have been measured.

2. Coatings deposition

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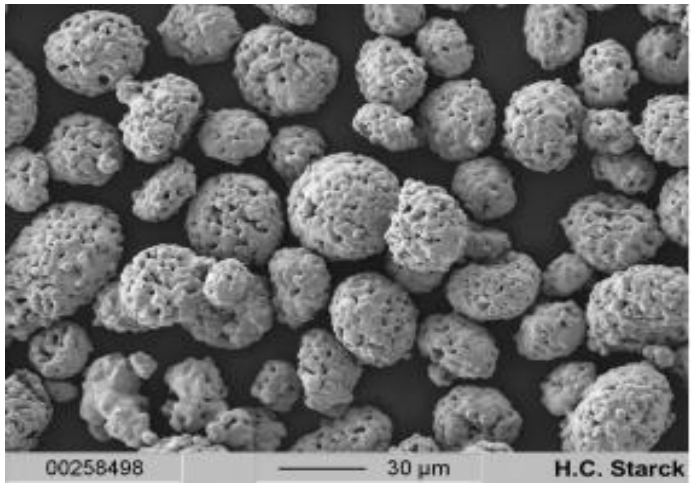
The chemical composition of the AZ31 magnesium alloy - substrate

Element, in wt. %	Mn	Zn	Al	Ca	Cu	Mg
AZ31	0.17	1	3	0.04	0.05	balance

The chemical composition of the composite powder Cr_3C_2 - NiCr

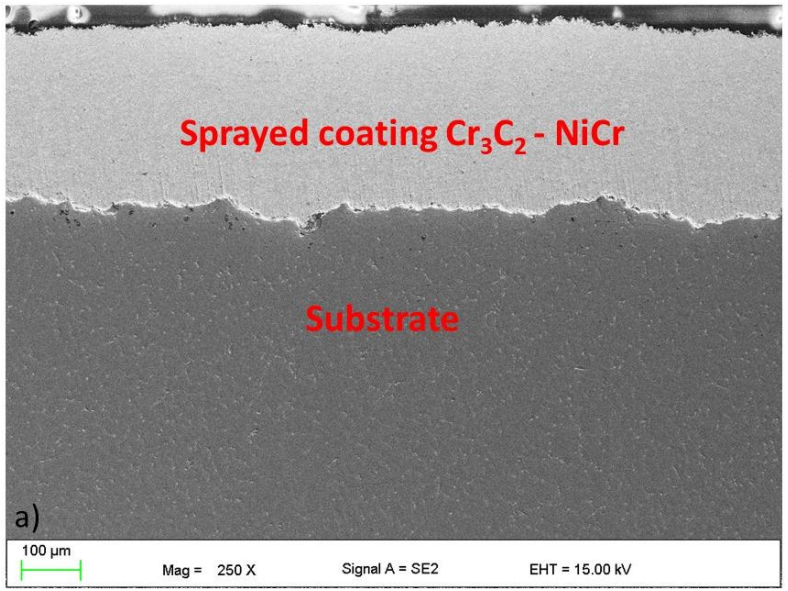
Element	In wt.%
Chromium	66 -73
Carbide	9 - 11
Fe	< 0.5
Nickiel	15 - 22
Oxygen	< 0.6

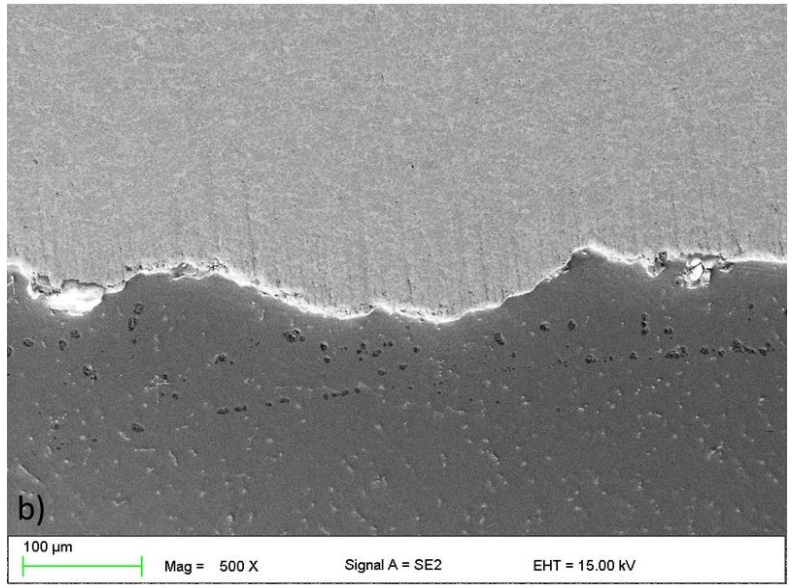


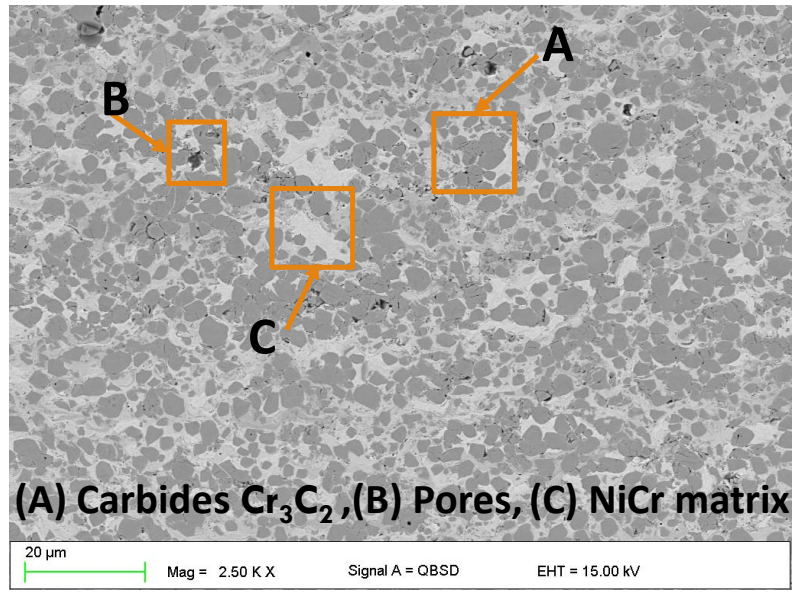
SEM (secondary electrons) micrographs of the Cr_3C_2 - NiCr powder

3. Results

3. 1. Coatings microstructure

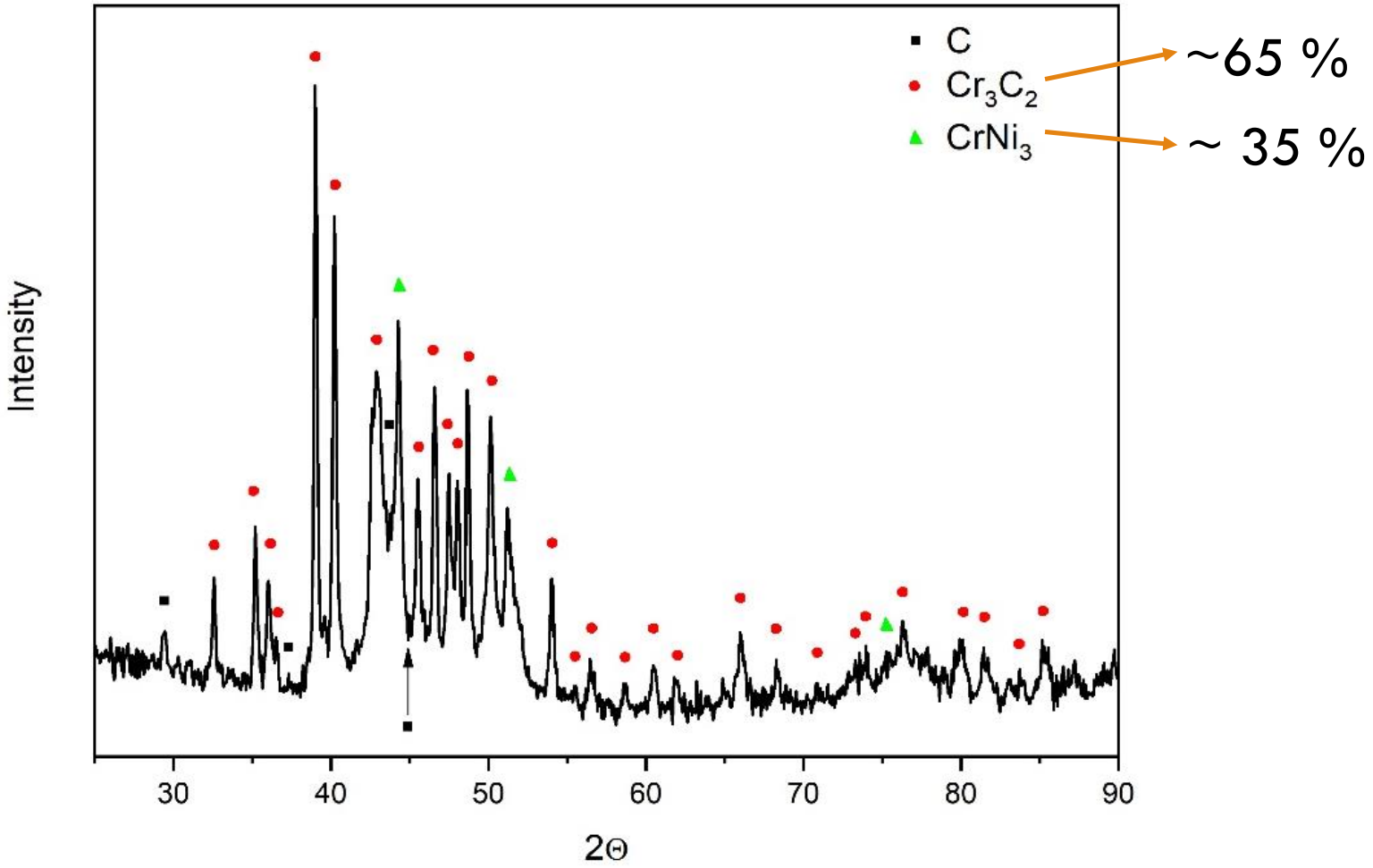






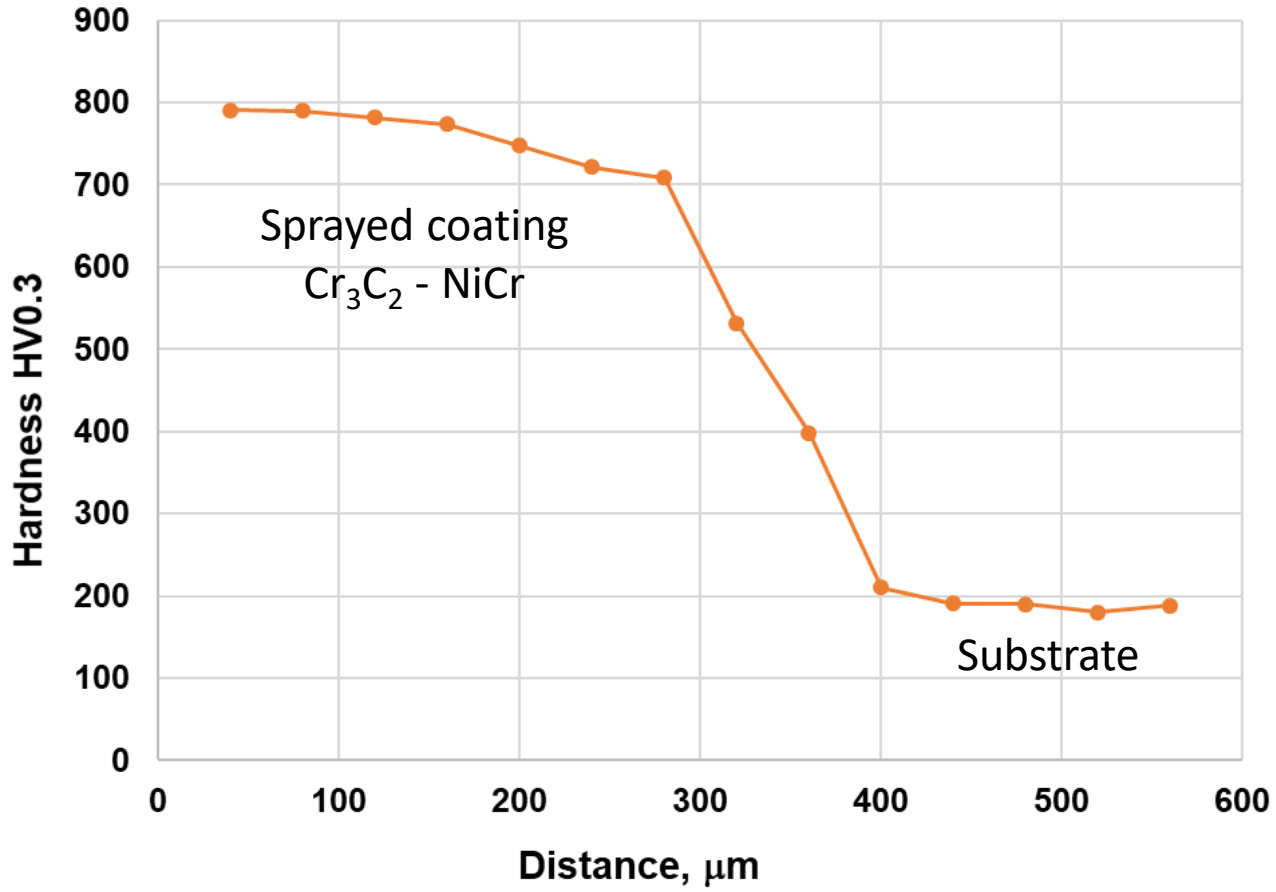
Cross - section of manufactured coating:
(a) mag. 150x, (b) mag. 500x and (c), mag. 2500x

3. 1. Coatings microstructure - -XRD analysis



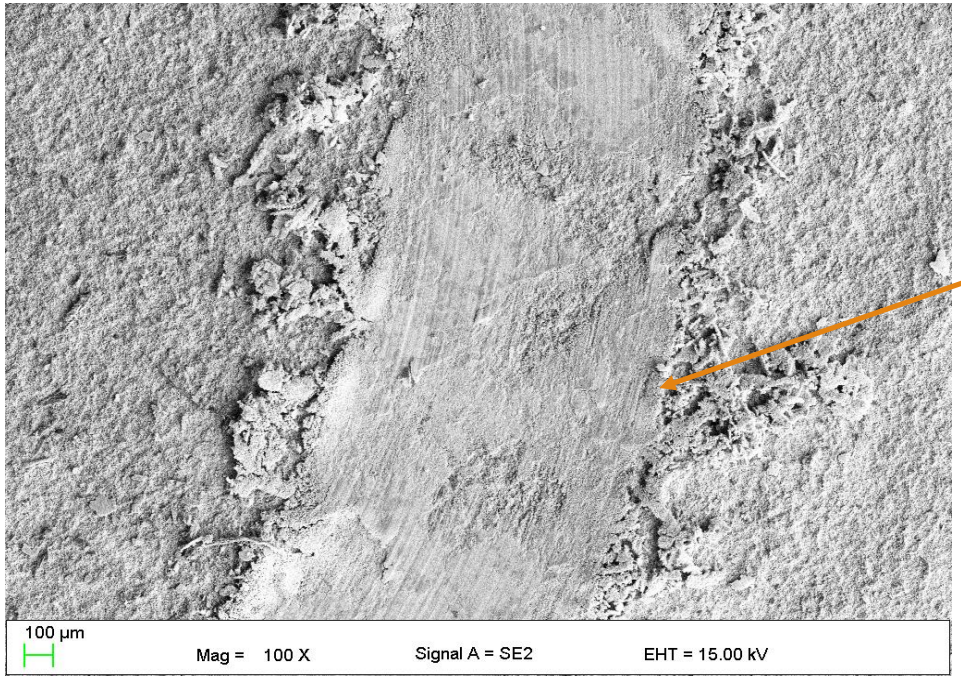
XRD pattern of the manufactured coating

3.2. *Microhardness*



Hardness distribution of coated sample from the surface to substrate

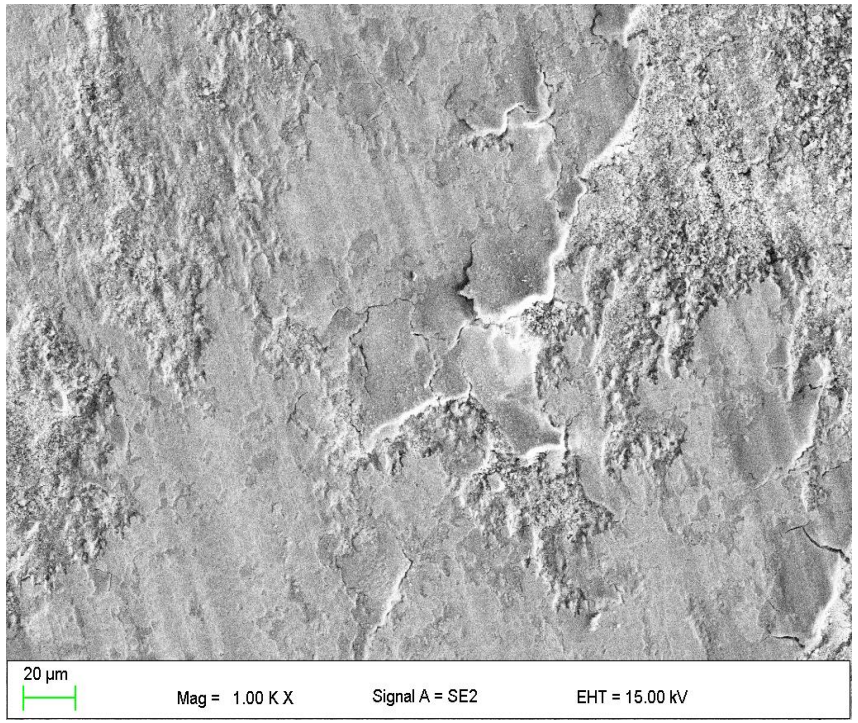
3.3. *Wear resistance*



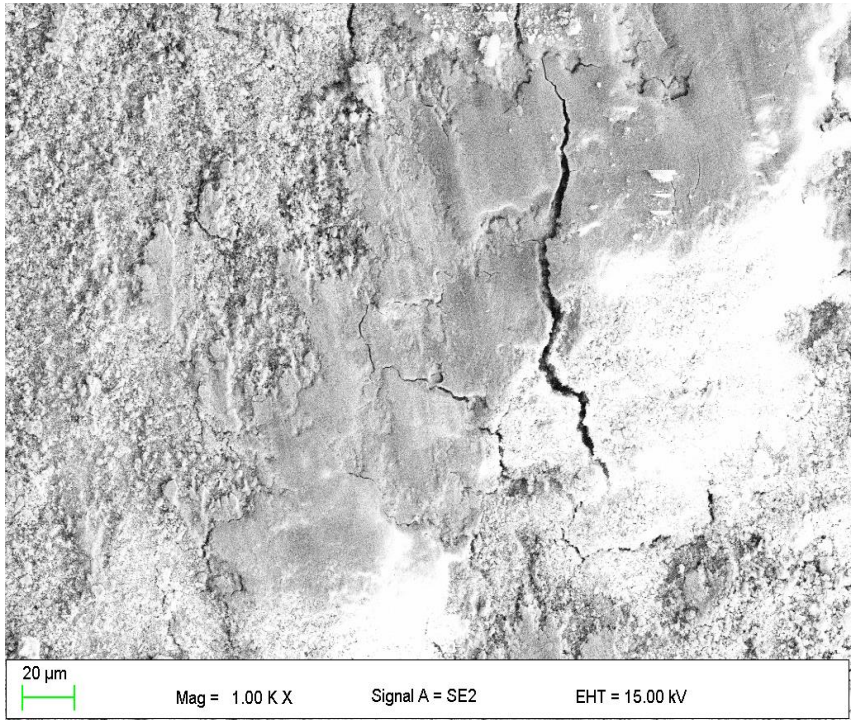
Wear traces of Cr_3C_2 - NiCr coatings, mag. 100x

The volumetric wear of investigated coatings was equal to 13.88 ± 3.11 · 10^{-6} mm^3/(N - m). The friction coefficient was equal to 0.6 ± 0.03.

a)



b)



Different wear mechanism of Cr_3C_2 - NiCr coating:
(a) low cycle fatigue, and (b) spallation and cracks

4. Conclusions

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In this preliminary studies, the Cr_3C_2 - NiCr coatings have been manufactured by HVOF method on the magnesium alloy AZ31. Based on the carried out investigations, the following conclusions can be drawn:

1. The obtained coating is characterized by homogeneous and dense structure, also no cracks or discontinuities were found on the surface of the produced Cr_3C_2 - NiCr coating.
2. The thickness of the manufactured coating was about 300±15 µm.
3. Measurements of the microhardness distribution in the sprayed coating indicate an increase up to 790 HV 0.3 (substrate material was equal to 180 HV0.3).
4. In the sprayed coatings are two main phases, namely Cr_3C_2 and $CrNi_3$.
5. The dominant mechanism of wear is a classic adhesive one.

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