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ALUMINUM-BASED ELECTROSPARK ALLOYED COATINGS

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METHOD

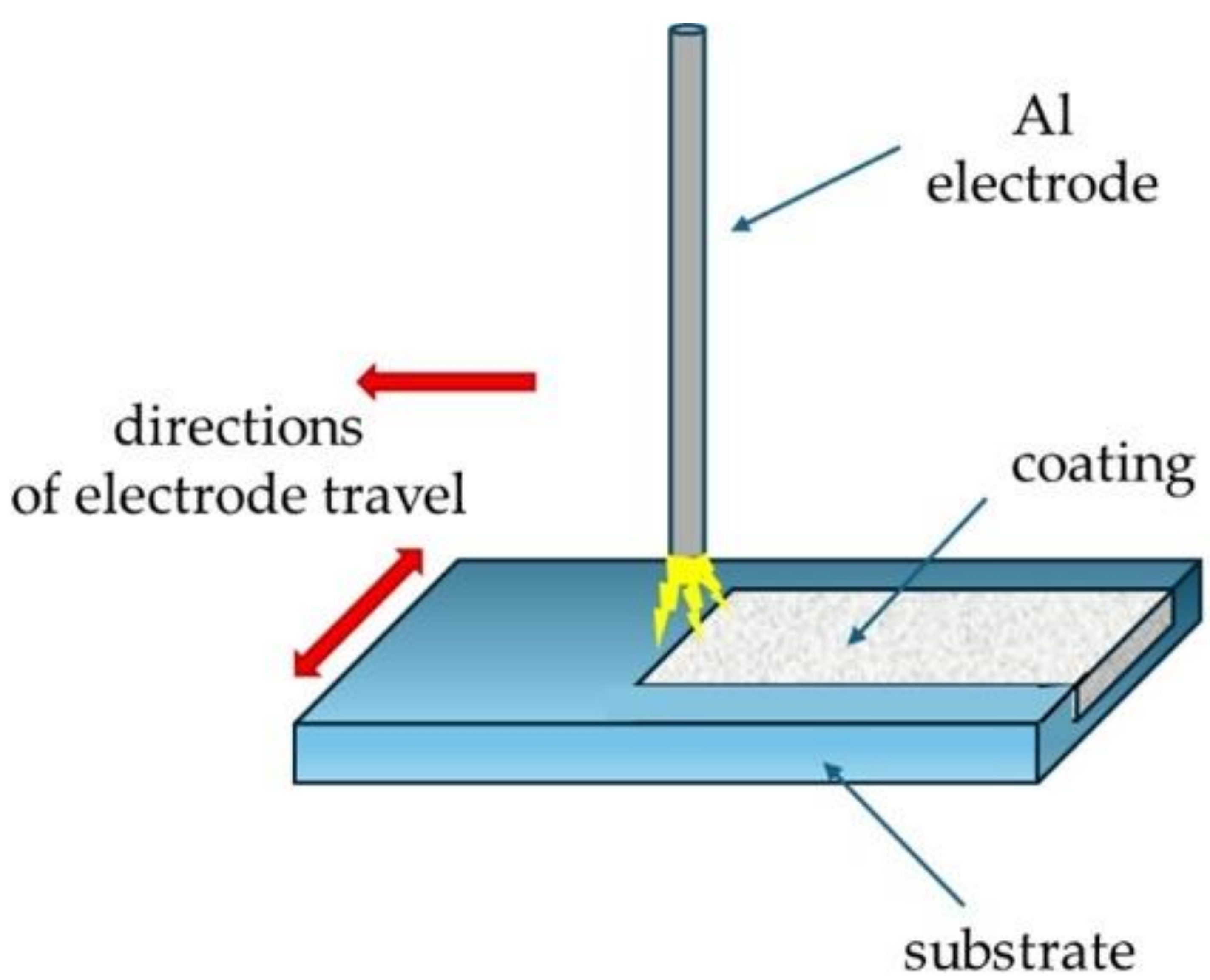
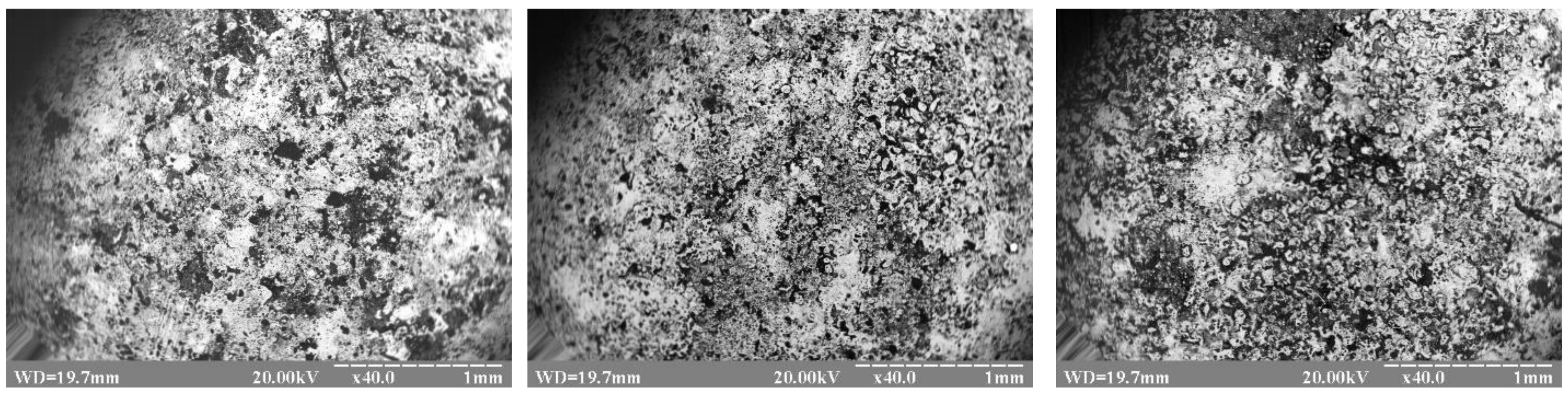


Figure 1 - ESA alitisation scheme

Table 1 - ESA modes using the "traditional" method ("Elitron-52A")

Mode number	Discharge energy, W_p, J	Voltage, V	Capacitance, C, μF	Productivity, cm^2/min
1	0.52	75	300	1.0-1.3
2	1.30	95	480	1.3-1.5
3	2.60	75	1560	1.5-2.0
4	4.60	100	1560	2.0-2.5
5	6.80	210	2040	2.5-3.0

RESULTS & DISCUSSION



a b c

Figure 2 – Aluminised coating morphology on C20 steel after ESA at discharge energies: a - 0.52 J, b - 1.30 J, c - 2.6 J

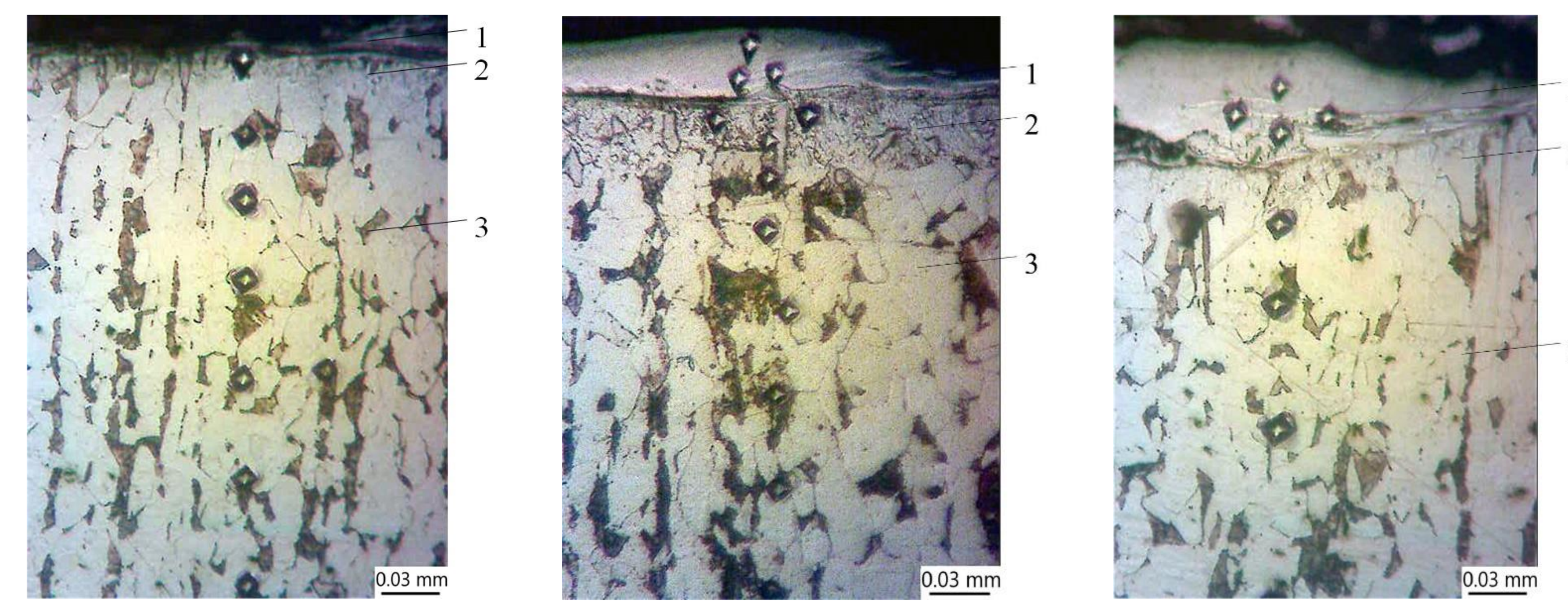


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Figure 3 - Structure of the alitised coating (optical microscopy) on steel C20 after ESA at the discharge energy: a – 0.52 J, b – 1.30 J, c – 2.6 J.
Areas of microstructure: 1 – "white" layer, 2 – diffusion zone, 3 – substrate.

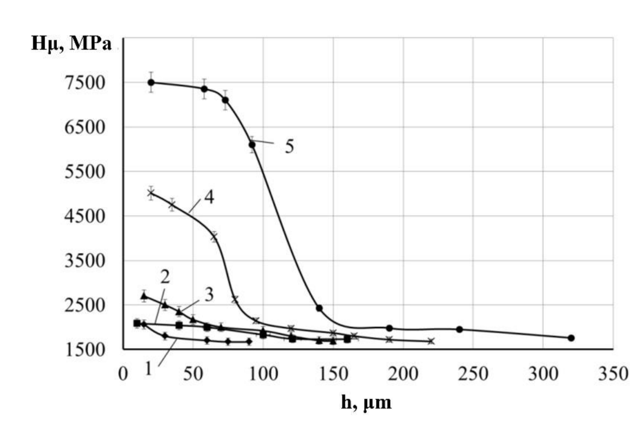
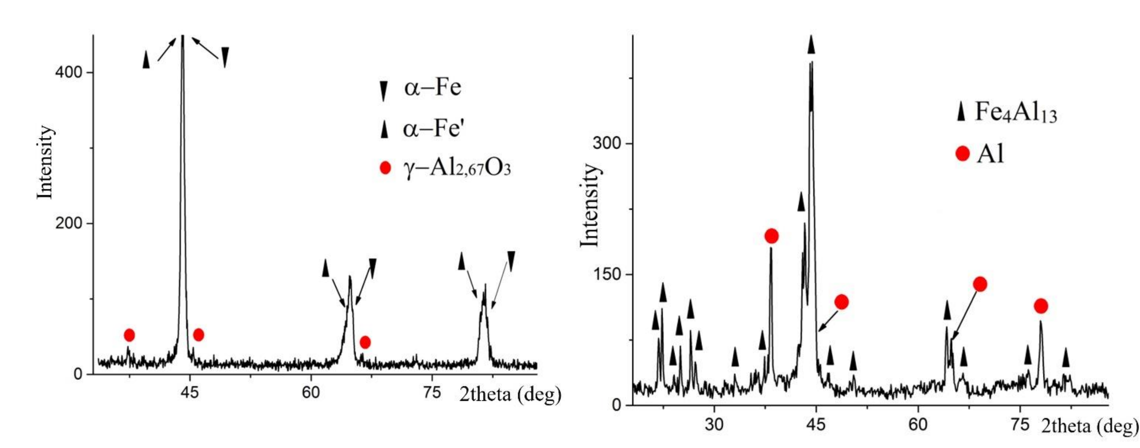


Figure 4 - Distribution of microhardness (Hμ in the aluminised coating (h) on steel C20 during ESA with discharge energy: 1 – 0.52 J, 2 – 1.30 J, 3 – 2.6 J, 4 – 4.6 J, 5 – 6.8 J



a b

Figure 5 – Diffractograms of coatings on steel 20 after ESA alitisation at discharge energies: a – 0.52 J, b – 1.30 J

CONCLUSION

1. An analysis of the literature to identify trends in improving the wear and heat resistance of materials has shown that an effective and economical way to increase the durability of parts is to create functional coatings on working surfaces. The electrospark alloying (ESA) is energy efficient, environmentally friendly and has a number of other advantages. It allows the creation of surface structures with unique physical and mechanical properties.
2. The peculiarities of microstructure formation during the alloying of steels C20 and C40 under different modes and methods of ESA are considered. The "classical" alloying modes, ESA with an aluminium electrode.
3. As the discharge energy rises, the qualitative parameters of the surface layer increase, such as thickness, microhardness of the 'white' layer and the transition zone, and roughness. Increasing the discharge energy during ESA leads to a change in the chemical and phase composition of the layer: at low discharge energies, a layer is formed that consists mainly of α-Fe and aluminium oxides; as the discharge energy rises, the layer consists of iron and aluminium intermetallics as well as free aluminium.

FUTURE WORK / REFERENCES

In the future, we are planning to conduct tests at reduced performance parameters.