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**Automated precision microplasma deposition of powder coating multifunctional systems**Darya Alontseva<sup>1</sup>, Elaheh Ghassemieh<sup>2</sup><sup>1</sup>East-Kazakhstan State Technical University, Ust-Kamenogorsk, Kazakhstan <sup>2</sup>Queen's University of Belfast, Belfast, United Kingdom

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The paper describes the results of developing a new technology of precision application of powder coating multifunctional systems to protect surfaces of industrial products using microplasma material processing complex with the assistance of an industrial robot. The choice of components for developing multifunctional powder coating systems, the trajectory of the plasma source and processing modes are carried out on the basis of optimized condition identified by initial experimentation and mathematical modeling. The use of a robot provides high accuracy and performance of coating deposition onto parts with complex shape. The use of this technology allows receiving multifunction systems of powder coatings with predicted nanostructure and a complex set of properties: heat-resistance, hard wear resistance. Research methods: analytical and computational simulation, transmission and scanning electron microscopy with energy dispersive analysis, X-ray structure phase analysis, mechanical testing (micro hardness, corrosion and wear resistance). Results: 1) A mathematical model and a program to run a robot arm according to the given trajectory have been developed to carry out the deposition cycle of selected materials with the help of the robot. 2) A proprietary software product to perform calculations of temperature fields in a number of industrial materials under irradiation has been developed and evidence-based recommendations on the choice of modes of surface modification by the microplasma (the trajectory and speed of the plasma source, the power density of the microplasma) have been provided. 3) The laboratory samples with protective powder coatings deposited by the microplasma onto various steel substrates have been obtained, and their structural and phase composition and performance properties such as microhardness, corrosion and wear resistance have been investigated.

Conclusion: the scientific bases of surface modification technology by microplasma exposure were developed, and a fully automated pilot production site has been implemented.

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powder coatings