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Transformation metals and alloys to the composite materials

Yulia Usherenko[1] , Sergei Usherenko[2], Javad Yazdani[2]

[1] Laboratory of Powder Materials, Riga Technical University, Latvia
[2]Mechanical and technological faculty, Belarusian National Technical University, Belarus
osher_yu@mail.ru

INTRODUCTION

It is complicated to create new materials with high complex of physical-mechanical properties on the base of traditional approaches. Commonly used technologies are either not able to provide the desired level of properties (doping, modification), or their use is expensive and energy-consuming (traditional powder metallurgy and composite materials). An alternative is to create a composite of cast metal pieces by super-deep penetration (SDP). Super-deep penetration is a complex physical phenomenon, when in a split second bunch of powder particles with a fraction less than 200 microns, accelerated to speeds of 700-3000 m/s, penetrates into the solid metal body at depth in tens, hundreds mm. An anisotropic composite is forming [1-2].

EXPERIMENTAL METHODS

For processing in SDP mode Pb and SiC powders with fraction 1-100 microns were used. The samples preparation technique includes cutting, polishing and etching in 4% nitric acid. Structures were studied by Hitachi s-4800 SEM, elemental analysis was made with QUANTAX EDS (P/B ZAF method). Electrochemical phase analysis, measurements of electrical resistance of the processed materials were carried out.

RESULTS AND DISCUSSION

Weight loss and therefore change of corrosion resistance of Al-12%Si alloy samples processed in SDP mode by Pb powder and SiC powder differ considerably at various stages. For example, the initial Al-12%Si sample after 980 minutes of electrochemical etching lost $3537 \cdot 10^{-8}$ kg, sample processed with Pb powder lost $2578 \cdot 10^{-8}$ kg. Thus its corrosion resistance increased compared to the initial material by 18%. At that time the Al-12%Si sample processed by SiC powder lost $4211 \cdot 10^{-8}$ kg, i.e. corrosion resistance of SiC powder processed material decreased by 27%.

The measurement of the electric resistance revealed an increase in electrical resistance in the longitudinal direction by 1.5 times. Thus material with high anisotropy of electrical properties was created.

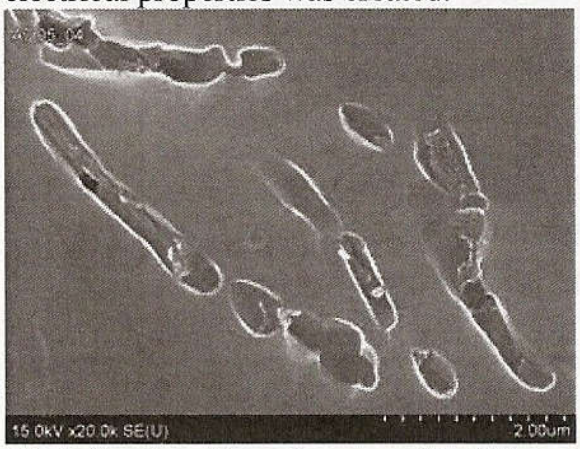

Fig.1. Structure of sample processed by SiC powder in SDP mode

CONCLUSION

Depending on the composition of powders and matrix material it is possible to vary properties of the resulting composite in a wide range. Thus, processing by Pb powder allows creating corrosion-resistant materials, and processing by SiC powder - porous filter material.

REFERENCES

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