Nanostructured surfaces

Structural transformations in oxide ceramic coatings formed on aluminum alloys in silicate electrolyte.

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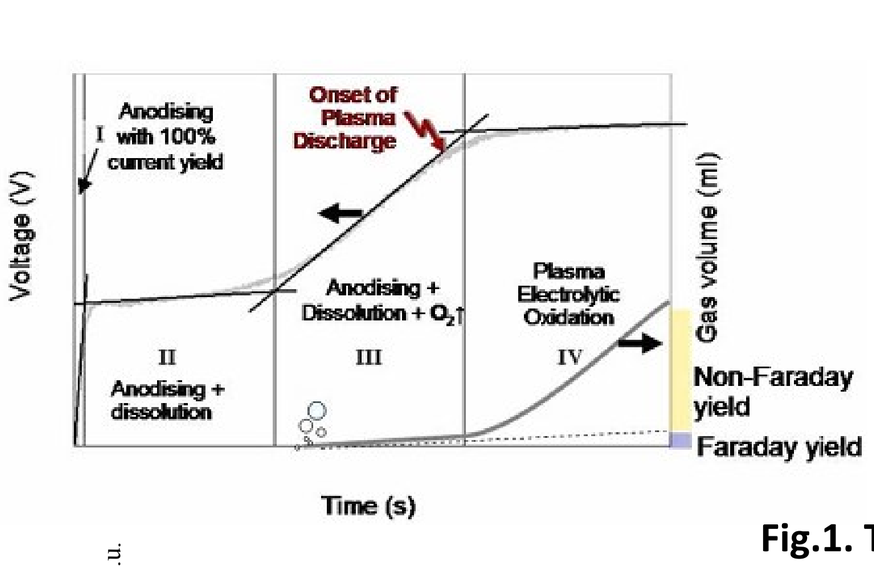

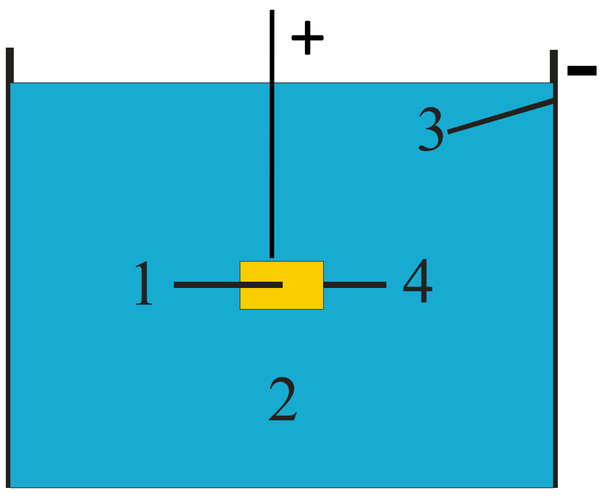

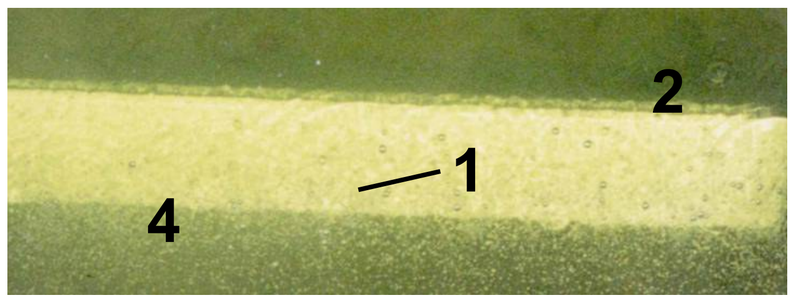

1 - aluminum alloys ; 2 – electrolyte;
3 - bath; 4- spark discharges.

Fig.1. The process of plasma electrolytic oxidation

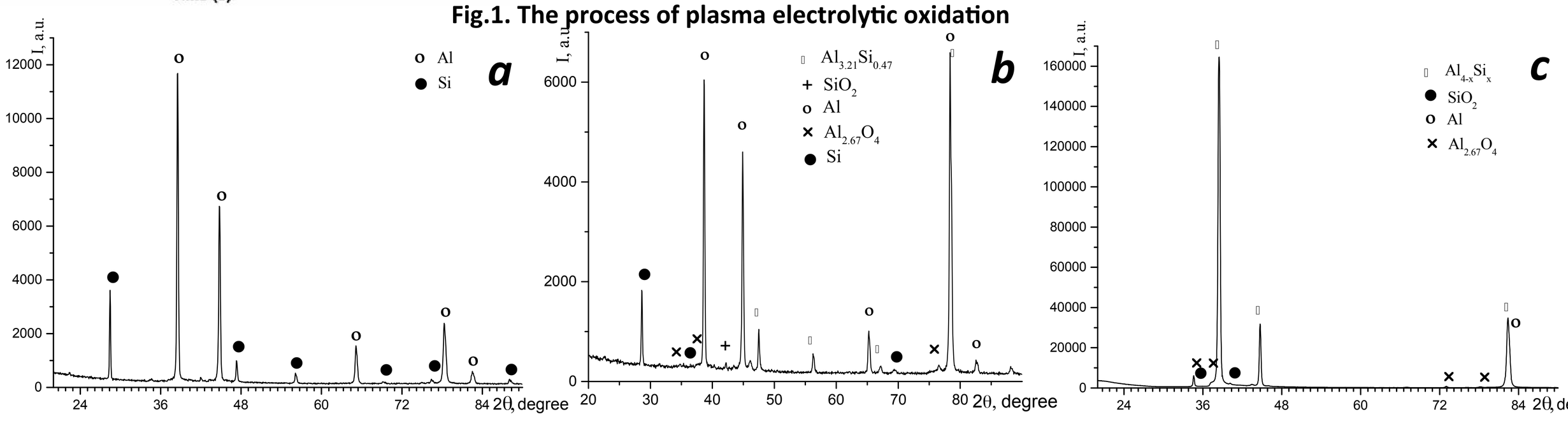

Fig. 2. X-ray diffraction of initial alloy AK9M2 (*a*) and oxide ceramic coatings after 5 min synthesis on AK9M2 (*b*) D16 T (c) alloys.

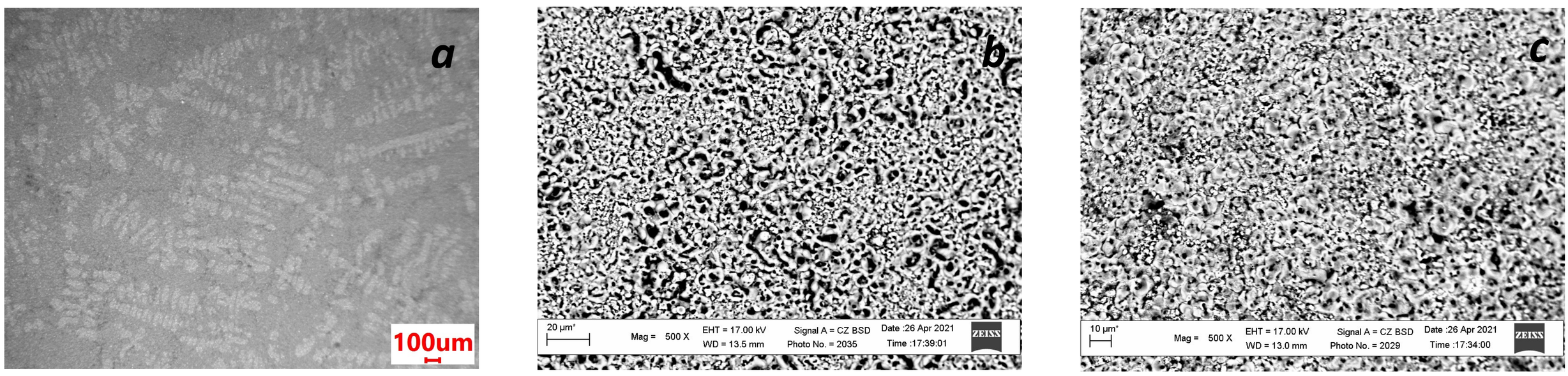

Fig. 3. Surfaces of oxide ceramic coatings on AK9M2 (a, b) and D16T (c) alloys after 5 min PEO synthesis.

Conclusions

X-ray phase analysis of oxide ceramic coatings formed on the alloys D16T and AK9M2 in the process of plasma electrolyte oxidation in the electrolyte (KOH (3 g/l), Na2SiO3 (2 g/l) is fulfilled. It is established that at the beginning of the coating synthesis (after 5 min) there is a transformation of the crystal lattice of aluminum with the formation of the compound Al3.21Si0.47 in the surface layers of both alloys. After 1h of synthesis, the corresponding oxide ceramic coatings on alloys D16T and AK9M2 contain the following phases: α-Al2O3 (corundum), γ-Al2O3, and Al2O3 · SiO2. (sillimanite). When increasing the synthesis time to 2 h there is a partial conversion of sillimanite (Al2O3 · SiO2) to mullite (3Al2O3 · 2SiO2) in the coatings on the alloy AK9M2. The study of the surface microstructure showed a uniform growth of oxide ceramic coatings and an increase of Si areas due to the formation of SiO2 and the formation of a low-temperature substitution compound Al3.21Si0.47. The image segmentation method was used to analyze the pore sizes and the probable distribution and size of bit channels. It is established that the porosity of the coatings after 5 min synthesis is 9-13% and pore size (0,052 – 59,452) µm^2.

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