

The Research of Structure and Morphology of Powder type D-16 and Material on It's Basis Obtained by Method of 3D Printing

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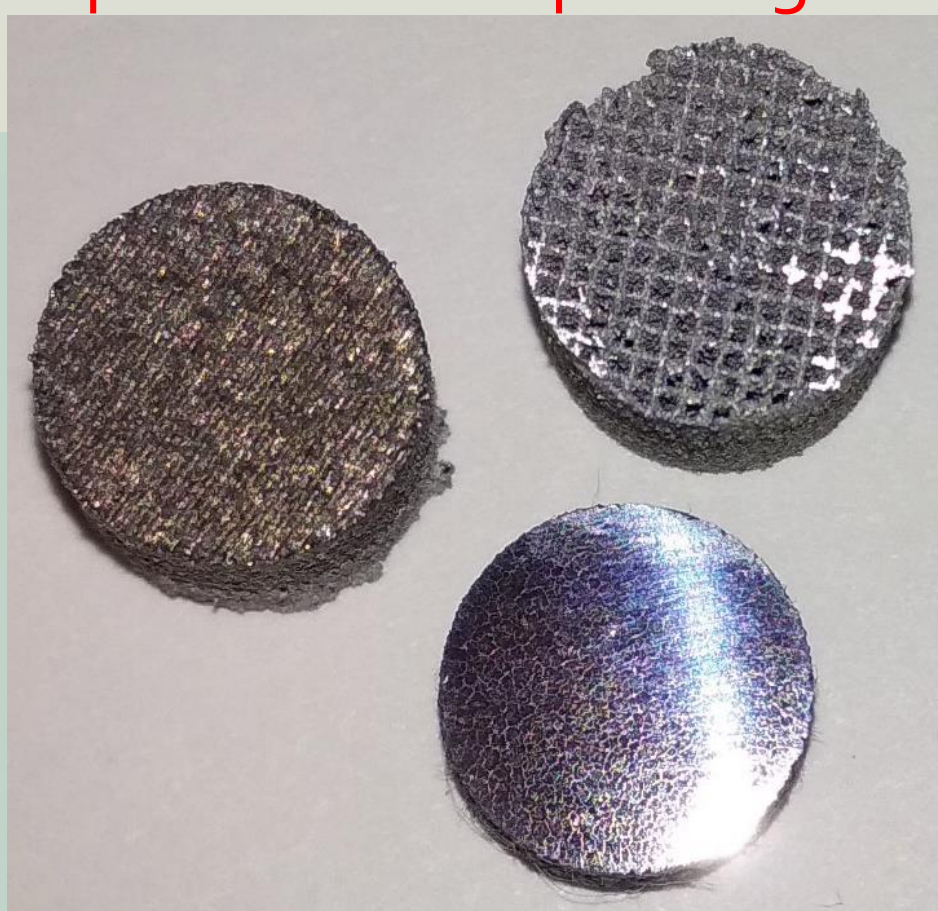
Aluminum alloys with copper as a structural material are widely used in various fields of industry. Currently, there is growing significant interest in the method of 3D printing of products based on ferrous and non-ferrous metal alloys using selective laser fusion (SLF) technology. In addition to choosing the type of laser and the parameters of the manufacturing process, the quality of the materials obtained is influenced by the physicochemical properties of the initial powder (the stability of oxide films on the surface of particles, the tendency to form low melting phases, etc.).



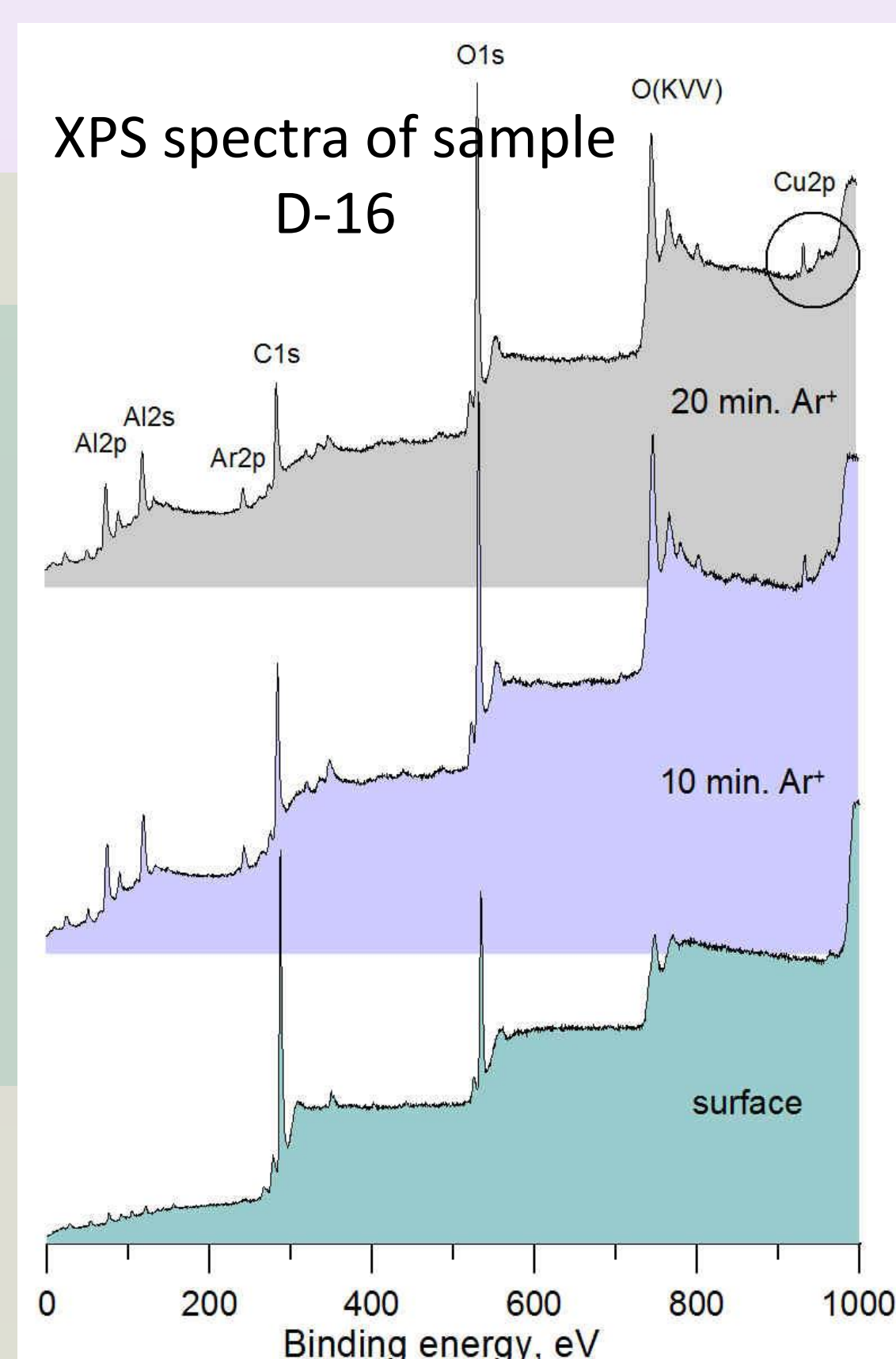
EOS M 280

Results

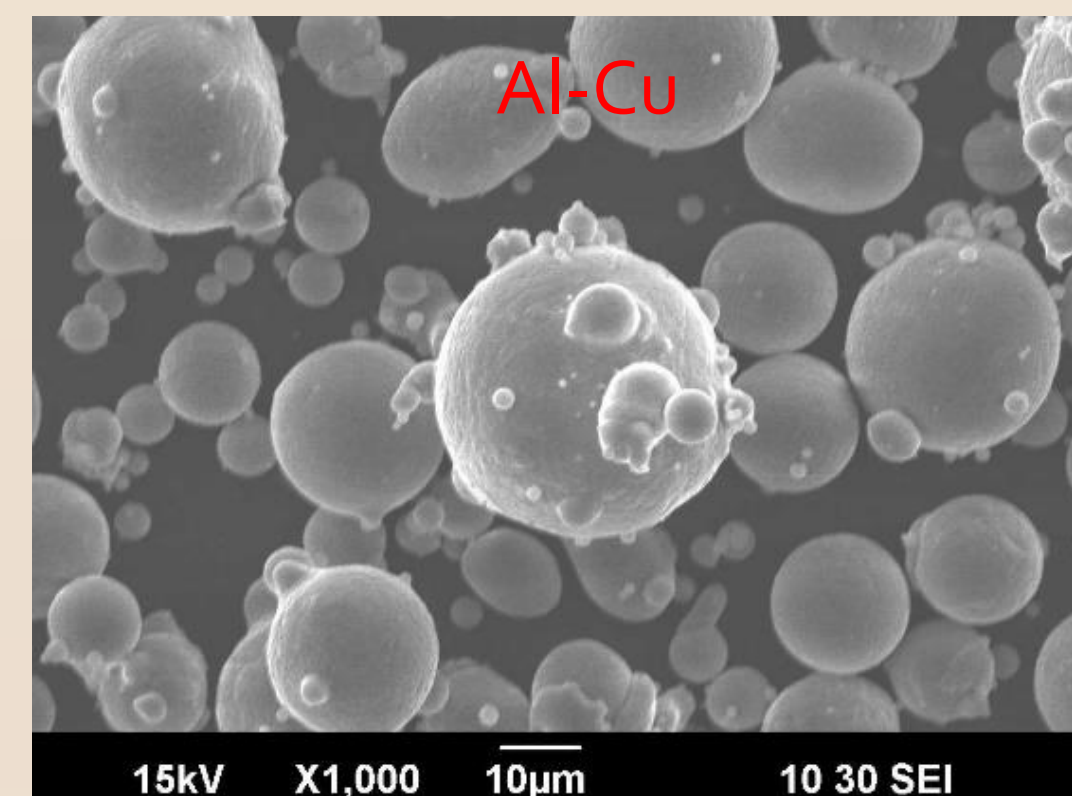
Sample D-16 after printing



• 10 mm diameter



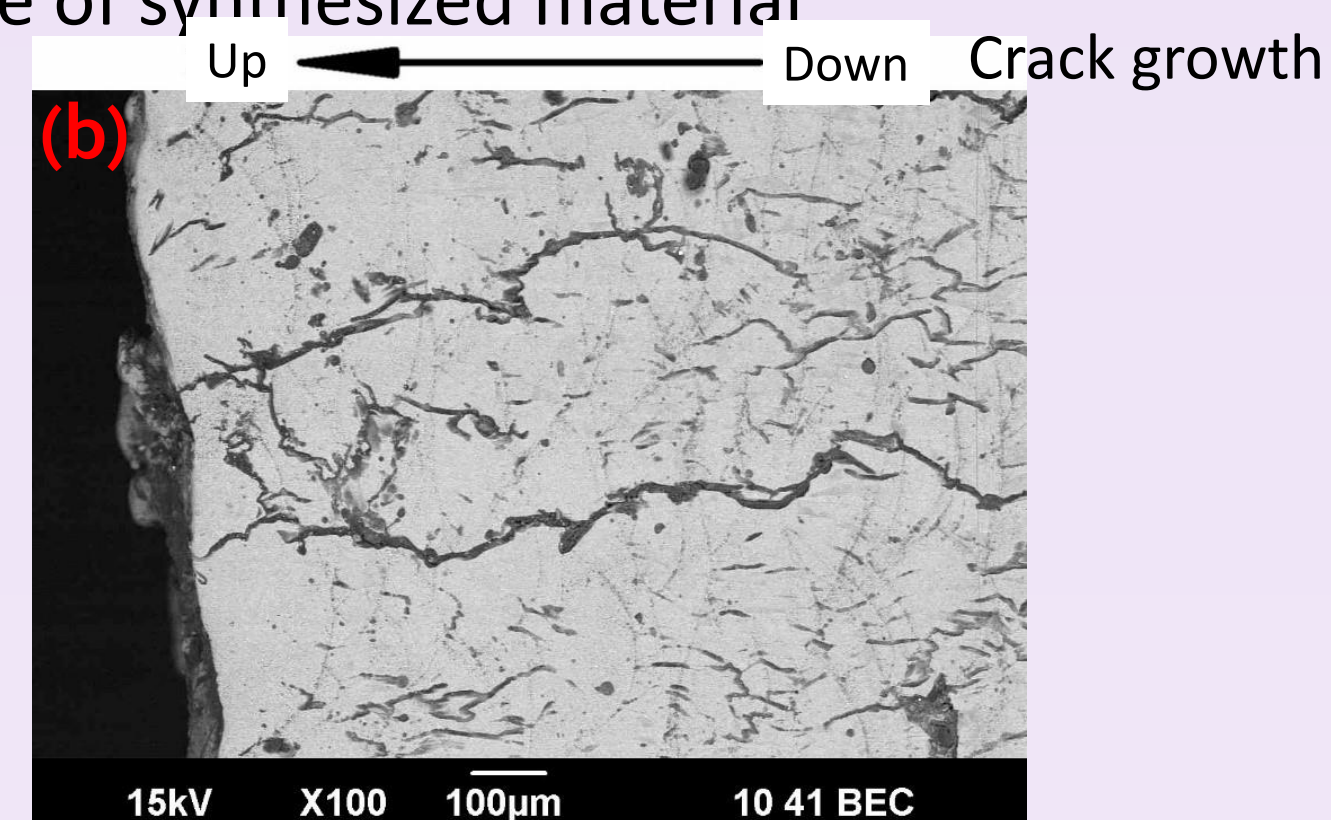
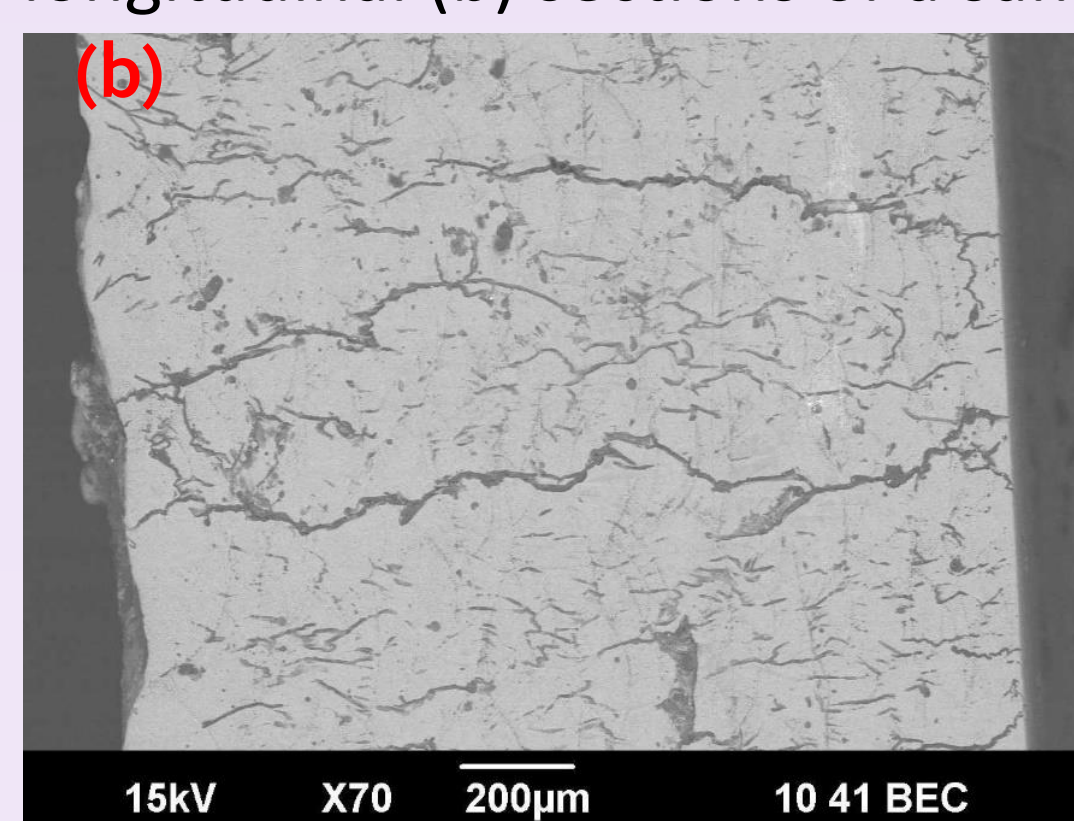
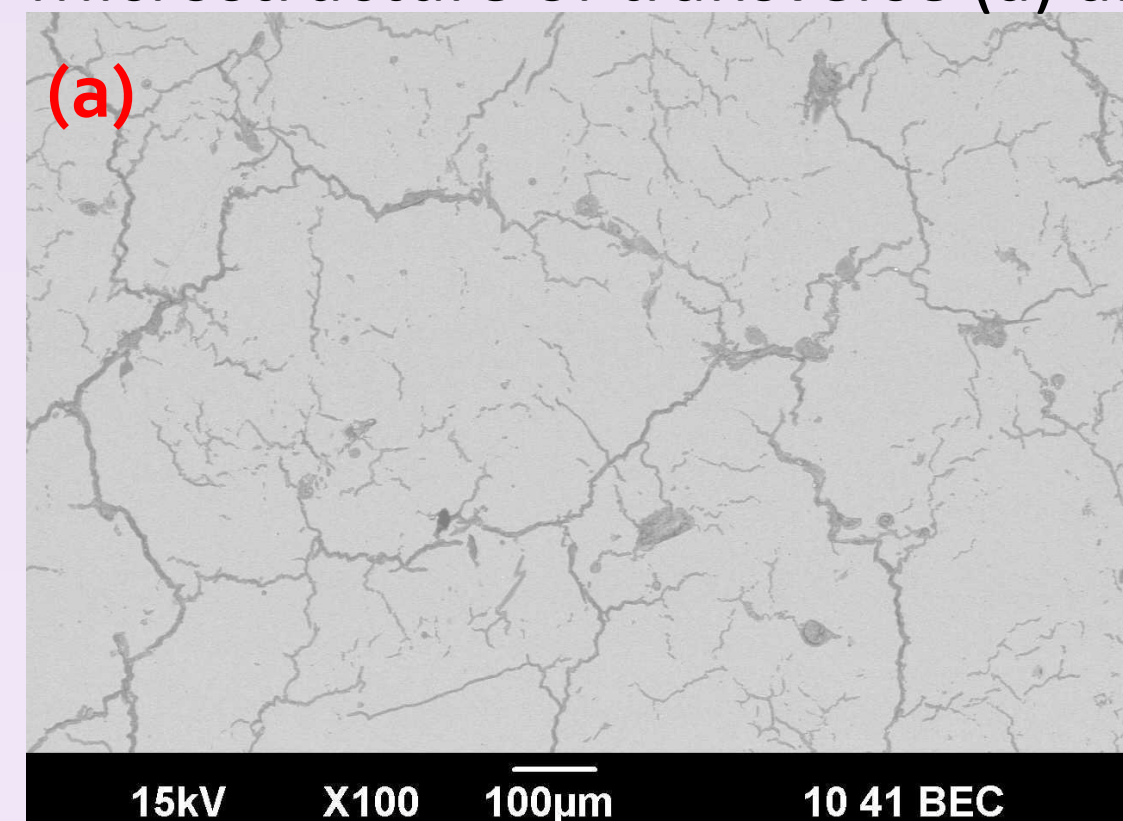
- Al_2O_3 layer about 3 nm thick
- Al-Cu metal alloy with a copper content of ~ 5%
- Local regions with a high copper content (up to 13 at.%) Were found at crystal grain boundaries



Morphology of alloy powder (D-16)

- Spherical shape of particles
- The copper content is 5 at. %

Microstructure of transverse (a) and longitudinal (b) sections of a sample of synthesized material



- Porosity: 5-6%

Conclusion

1. Significant porosity of the fused sample due to cracks arising during the crystallization of the alloy has been established.
2. Oriented crack growth was found to be associated with the "support" mesh structure on which a material sample is formed, caused by the nature of the crystallization of the melt of the studied composition.
3. Elimination of significant porosity of the material is possible by searching for optimal printing conditions and alloy composition, taking into account the requirements for the mechanical properties of the material.