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ANALYSIS AND DEVELOPMENT PROSPECTS OF 3D-PRINTING WITH METAL POWDERS

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3D metal powder 3d printing technology improved and affordable daily. 3D-printers themselves, as well as materials used for printing, are being improved. Naturally, the cost of printing with metal is quite high – approximately 50 times more expensive than plastic printing. However, the cost is justified, especially when manufacturing a unique part in single copies. Traditional production methods such as milling on CNC machine tools and castings are very expensive. How does metal printing work for a 3D-printer, similar in cost to a small airplane? As in the case of printing polymeric materials, the work begins with modeling, in which all sizes of the future product will be set. Designers or engineers create all models, after which there is a check for integrity and the absence of software errors. Usually, before printing with metal, a plastic prototype of the part is made in order to finally identify and eliminate shortcomings or errors. The resulting plastic prototype is installed in a mechanism or device in which it will work or be scanned to eliminate inaccuracies. When all the checks have been completed, 3D-printing is launched using direct laser sintering technologies for metals. The laser, which has a power of 400 W, sinters a thin layer of special metal powder – it draws sections of the part, where the baked part in layers forms the body of the future product. Then the next layer of powder is applied and the process is repeated – layer-by-layer, the model takes shape. The platform, on which the item is located, is lowered on the layer thickness and the powder is fed. Excess metal powder are collected and reused during the next print. The finished part is removed from the platform, scanned and checked for compliance with the design documentation and sent to customers. Further processing may include removal of supports and powder residues. Thermal annealing is used to relieve stress and improve the mechanical properties of the product. Depending on the purpose of the part, metallization, pressure treatment, polishing and final finishing on CNC machines can be used. The advantage is that printing with metal powder gives a density index of 1.5 times higher than when casting, can create geometrically complex, miniature objects, can use a wide selection of metal alloys – standard and special, and the output of finished products is accelerated.

References

1. Milan Brandt Laser Additive Manufacturing. Materials, Design, Technologies, and Applications / Milan Brandt. – Cambridge, United Kingdom: Elsevier science & technology, 2016. – 498 p.