Государственный научный центр РФ ЦНИИТМАШ

атомэнергомаш
ГРУППА КОМПАНИЙ РОСАТОМА

Equipment for Additive Production

3D-Printer for Metal Parts Using the Selective Laser Melting Method (SLM)

Melt Master^{3D} -550

JSC "RPA "CNIITMASH" is focused on solution of complex multifaceted issues related to manufacturing of unique equipment. The Institute capability of creating new technologies, instruments and equipment is based on deep fundamental and applied research in the field of materials science, protective coatings, casting production, pressure shaping, welding, cold metal work, nondestructive testing, strength calculations and other directions.

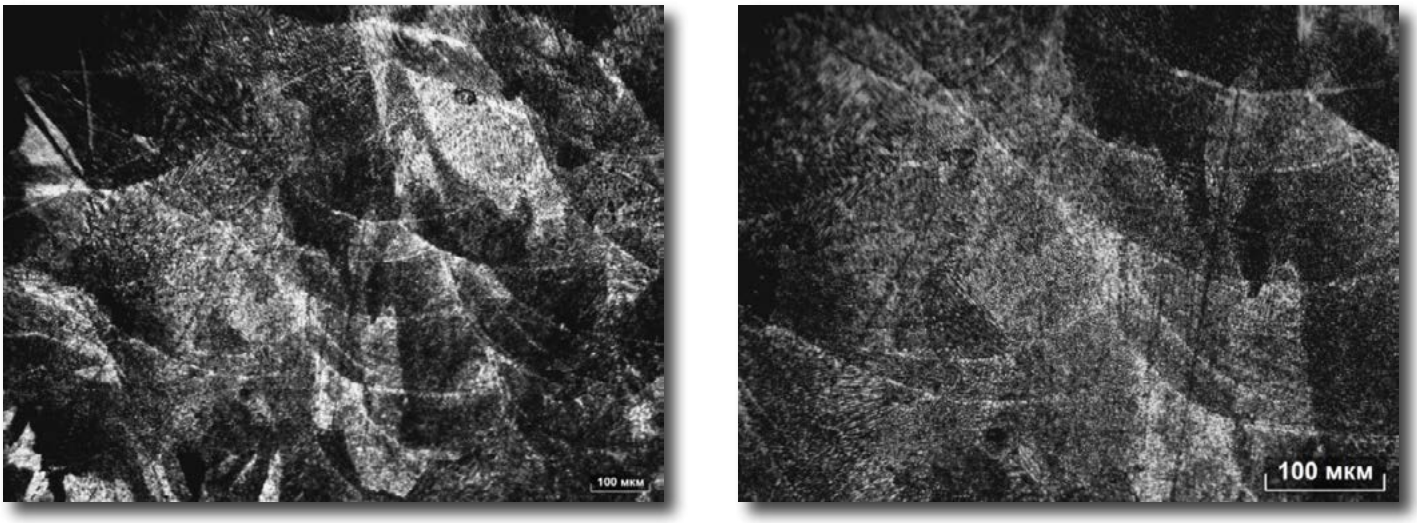
A unique industrial plant MeltMaster^{3D} -550 was developed in JSC "RPA "CNIITMASH". It is designed for three-dimensional printing of critical geometrically-complex items from metal powders using the method of selective laser melting. The plant has a high potential for adaptation to existing process lines of machine-building enterprises and will make it possible to significantly reduce the manufacturing time and production cost .

MeltMaster^{3D}-550 Technical Parameters

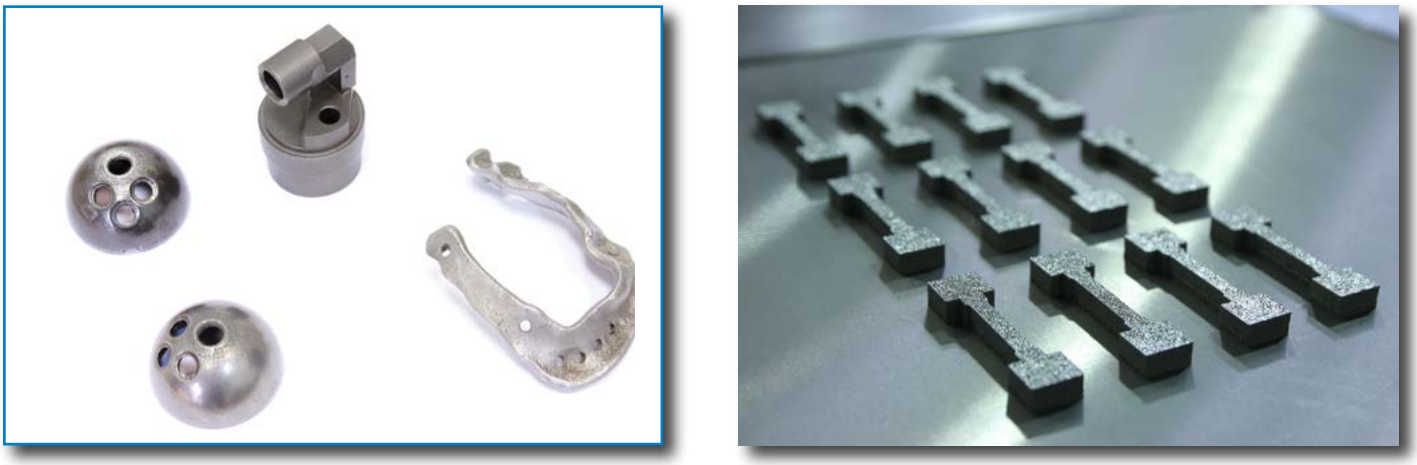
Buildup zone size, mm	550 × 450 × 450
Laser output power, W/ Laser type	Controlled 100-1000 / Fiber laser, ЛК-1000-ОМ
Performance, cm^3/h	15-100
Layer thickness, µm	20-250
Laser spot diameter in focus, µm	50-700
Scan Speed, m/s	Up to 15
Inert gas	Argon /Nitrogen (consumption 5 l/min)
Requirement to compressed air	2.1 – 10.3 KPa
Weight, kg	~ 4500
Voltage	400 V, 50 A, 50/60 Hz, 20 KW/h

Microstructure

In the pictures there is a layered structure with distinctly different melting tracks. View and orientation of the crystals is characteristic for the cast structure of austenitic chromium steel in an after-casting state.



Pictures of microstructure of samples from austenitic corrosion-resistant steel 12X18H10T manufactured at MeltMaster^{3D}-550



Samples fabricated at MeltMaster^{3D}-550

MeltMaster^{3D}-550 Control System

The data on the laser output power and the beam speed are constantly fed into the control software and hardware complex. The content of the oxygen and hydrogen residual concentration is monitored by high-precision sensors, the prototypes of which are used in nuclear energy. Constant monitoring of the temperature in the melting zone and throughout the working surface with an estimate of the permissible thermal gradients is carried out in the process of operation.

Material

Various finely-divided, spherical and near-spherical forms of powder materials from pure metals and alloys based on iron, nickel, cobalt,

titanium, aluminum, copper, etc are used as raw materials for product manufacturing

The fractional makeup of the powder is 15-50 μm.

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