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Implementation of the Additive Manufacturing for metals approach: the production of the acceleration grids for DTT NBI project

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Acceleration grids of the Neutral Beam Injector in nuclear fusion reactors must be extremely accurate and satisfy specific geometrical requirements to work properly. The implementation of the additive manufacturing technology was proposed since 2017 starting the characterization of pure copper up to the recent excellent results in terms of density, process reliability and repeatability. To assure the required performance and maximize the beam optics and the overall system efficiency, an intense study of the geometry of these components was performed, adopting a spherical aspect of planes. The material selection was also an important step of the work. An integrated cooling system, peculiar of the AM technology, was optimized, ensuring a relevant reduction of temperature peaks. Pure copper and CuCrZr alloy were investigated for reaching the best material properties: parameters optimization was executed using different machines and laser beams, and several post processes were assessed, such as surface treatments to smooth the cooling ducts. After the material characterization, which was focused on the evaluation of density, thermal conductivity and mechanical strength of the AMed parts. Lastly, several prototypes were produced and power tests were carried out.

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Footnotes

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