Big Science Business Forum 2024

TRIESTE
1 – 4 OCTOBER 2024

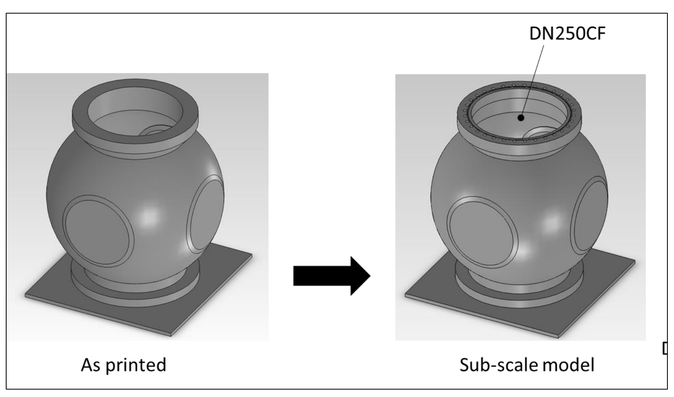
Host Organizers

Additive Manufacturing of vacuum chambers by using Plasma Metal Deposition (PMD®)

INTRODUCTION

Plasma Metal Deposition is an Additive Manufacturing method, which allows to fabricate large metallic structures. The technology is using a plasma transferred arc as a heat source which is used for the local melting of injected powders or wires.

In a first step a 3D CAD design is generated which is sliced into individual layers following by building of the vacuum chamber using the PMD technology.



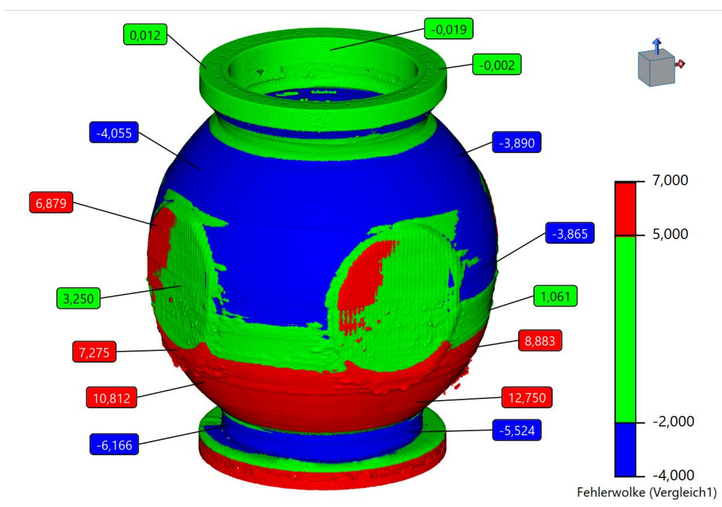
MANUFACTURING

The manufacturing of the vacuum chamber was done in inert atmosphere. For the chamber a titanium alloy was used in order to reach an Ultra High Vacuum (UHV) level of down to 10^{-8} mbar.

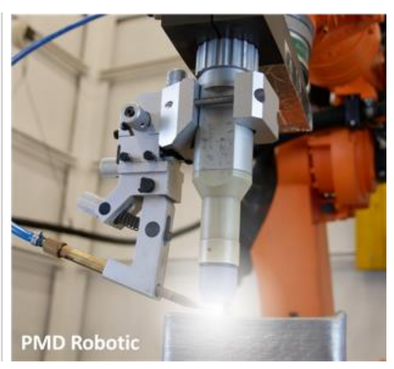
The following images show the sequence of building of the chamber. In order to realize overhanging structures, a 5 axis system was used allowing to tilt and turn the building platform. In overall a chamber with a height of approx. 530 mm was manufactured.

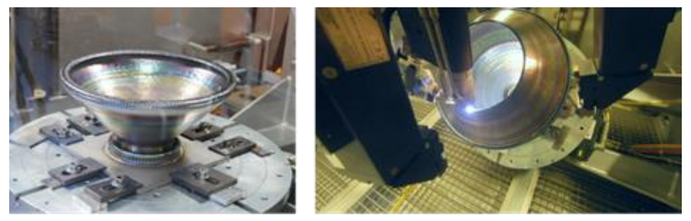
INSPECTION & RESULTS

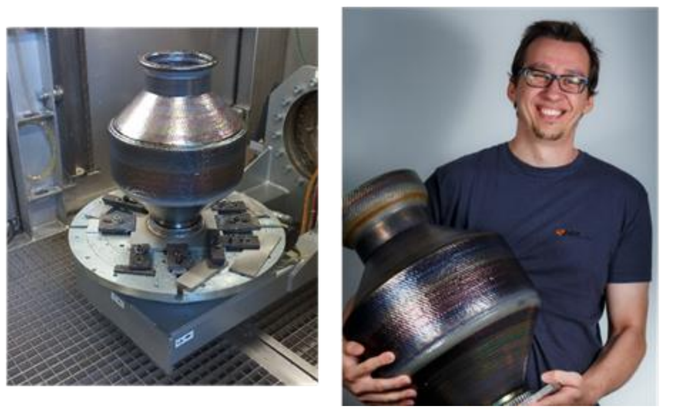
After the deposition process, which took approx. 60 hours, the vacuum chamber was analysed and inspected with respect to its dimensional deviations. Using 3D scanning the deviations to the original design can be visualized and used for the subsequent optimisation of the process.



Finally a successful vacuum test was done. It was possible to reach a level of 10^{-9} mbar in the chamber after a back-out at 120°C for 12 hours.







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