

## Selective Laser Melting applied in continuous production mode to overcome dimensional limits

Developed at KIT (Karlsruhe Institute of Technology), this technology offer gives the possibility to have an expansion of dimensional limits in Additive Manufacturing using powder bed processes. Inspired from other manufacturing technologies (e.g. extrusion), modifications for existing machine layouts have been designed and a concept has been developed allowing the operation of an SLM machine in quasi-continuous operation without length limits driven by the process chamber dimensions. Investigated for fusion components manufacturing, this technology and know-how could now find promising applications in the sectors of aerospace, energy and transports for 3D printing of long complex lightweight structures.

### Description of the technology

In additive manufacturing using powder bed processes, the dimensional limits of components are driven by the dimensions of the process chamber. This limit can be circumvented if the process chamber dimensions are expanded in building length direction. Scientists at KIT has reached this by using an interchangeable build platform inserted into a gate on the bottom side of the process chamber. The gate is equipped with a powder retaining system allowing the build platform to exit the process chamber continuously during the building process.

The process confinement is maintained by a shell which is built together with the product using AM where the shell is extending the building platform coincidentally shrouding the product inside. The building platform, shell and the product inside exit the process chamber through the gate where the powder retaining system is in contact with the external surface of the shell.

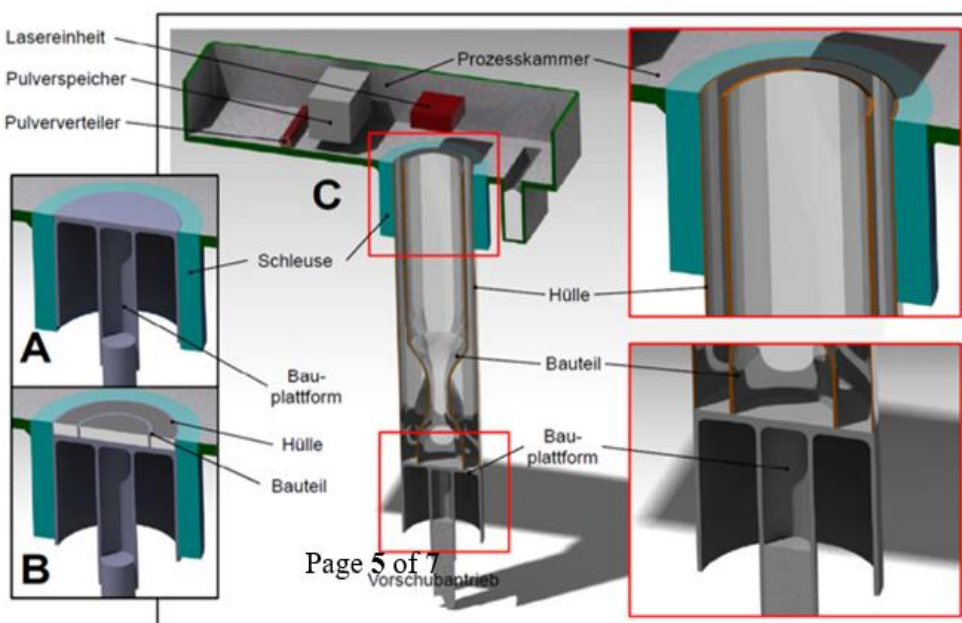


Fig.1 Plant design for continuous production

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### ■ Innovation and advantages of the offer

The innovation is the decoupling of the product length in building direction from the process chamber using analogies from different manufacturing technologies. Besides the size aspect, the technology provides additional features:

One AM-facility can be sued for a wide range of dimensions of products, the concept allows to react flexibly to customers wishes in terms of extra-ordinary length

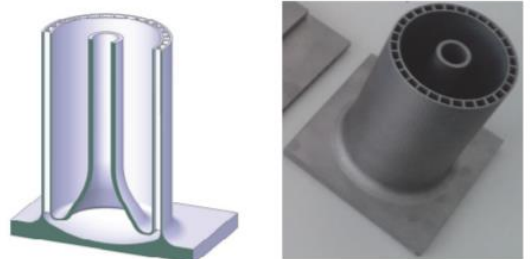
The ratio in between powder bed volume and product (length and diameter) can be optimized if the gate and powder retaining system is designed flexibly to allow installation of building platforms which different diameters

### ■ Non-fusion Applications

This technology and know-how could find promising applications in the sectors of civil engineering aviation, aerospace, energy for 3D printing of long and complex lightweight structures.

### ■ EUROfusion Heritage

The development of new manufacturing methods for the production of key components for nuclear fusion reactors by selective laser melting (SLM). SLM offers great potential compared with conventional manufacturing methods. In conjunction with feasibility studies, complex 3D structures such as a thin- and double-walled flow channel inserts (FCIs) for dual-coolant lead lithium blankets have been successfully manufactured and tested on a preliminary level. Several blanket components like thin- and double-walled 3D flow channel inserts for DCLL, HCLL or WCLL blankets as well as breeder blanket cooling plates with a complicate inner channel structures could be successfully fabricated by SLM.



*Fig.2 Example of HCPB fuel pin with aim to create a thin-, doublewalled structure with internal redirecting channels*