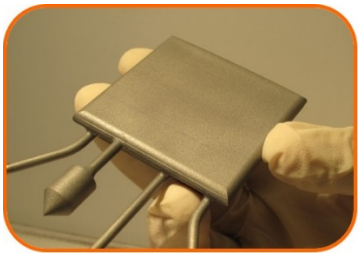
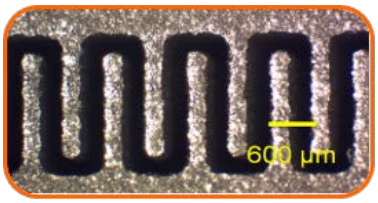
Additive manufacturing of Ti6Al4V heat switch:
towards optimal control of microstructure and residual stresses
(in co-operation with chair of Energy, Materials & Systems)
from September 2019

Additive manufacturing (AM) has opened up a world of new opportunities towards mold-free production of complex products. Products can be made with increased functionality, with a topologically optimized shape and/or designed to individual needs. One of the more important approaches for metal products is laser powder bed fusion (L-PBF), where metal powder is deposited layer by layer and a dedicated laser is used to melt the powder at selected locations according to the product design.





Within the chair of Energy, Materials & Systems dedicated heat switches based on a very small gas gap are being developed for use in various vacuum applications (see above). Current designs have a small thickness, typically smaller than 10 mm, and an area of 10 cm × 10 cm, but future designs call for larger areas up to 30 cm × 30 cm. Recent explorative research has indicated that current designs are strongly suffering from the development of residual stresses and anisotropic material properties. Hence, further optimization of the L-PBF process and related heat treatments is required to support the development of the larger designs.

In this master assignment the relation between process conditions, microstructure and the development of residual stresses will be investigated. The research comprises both experimental work (including the printing of test pieces) and the development of theoretical models.
The following aspects should be included:

(i) Literature study on the role of process conditions on microstructure and residual stress development of Ti6Al4V.
(ii) Experimental program dedicated to the relation between process conditions, microstructure and residual stresses. A large variety of microscopical and other analysis techniques are available within both research chairs.
(iii) Establish (model based) relations between relevant microstructure, residual stresses and process conditions to support future design changes.

Contact: More information: contact Ton Bor (t.c.bor@utwente.nl) 2453 (N203)
Srinivas Vanapalli (s.vanapalli@utwente.nl) 4839 (C2049)