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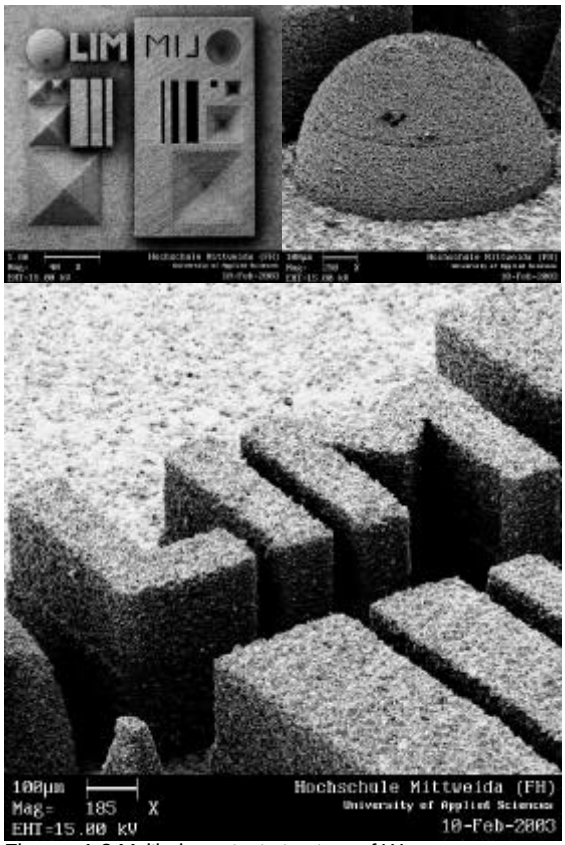
Novel Technology: Laser Micro Sintering

A novel technology for the generation of 3D microparts „3D-Micro-Sintering has been developed at the Institute in the course of a cooperative project - „Vakuum SLS“ (FK 02PP1110, Forschung für die Produktion von morgen, Projektträger FZK, Außenstelle Dresden) - aided by BMBF/PFT. A resolution <30µm could be achieved at an aspect ratio >10, presently the topmost resolution worldwide for an SLS-Process (Figs. 1-3). The technology implies the handling of ultra-fine powder and the performance of the SLS-process inside a vacuum /1,2/. Respective innovations were developed and patented.
Laser micro sintering allows optional firm connection of the generated body to a substrate or loose attachment to a reusable construction platform. Detachment of the parts is achieved simply by ultrasonification. The generated bodies are free of internal tensions.
As yet bodies and 3D-structures have been generated from W, W/Cu, Cu, Ti, Ag and Al. The technology is applicable with high as well as low melting metals. For the first time undercuts are possible on a micrometer scale (Fig. 4).



Figures 1-3 Multi-shape test structure of W

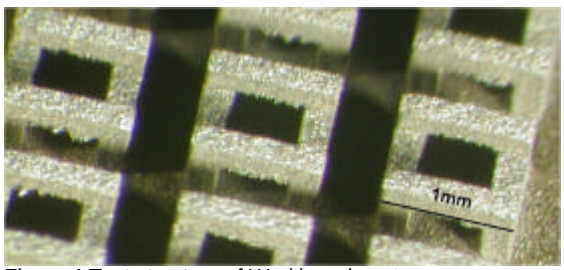


Figure 4 Test structure of W with undercuts

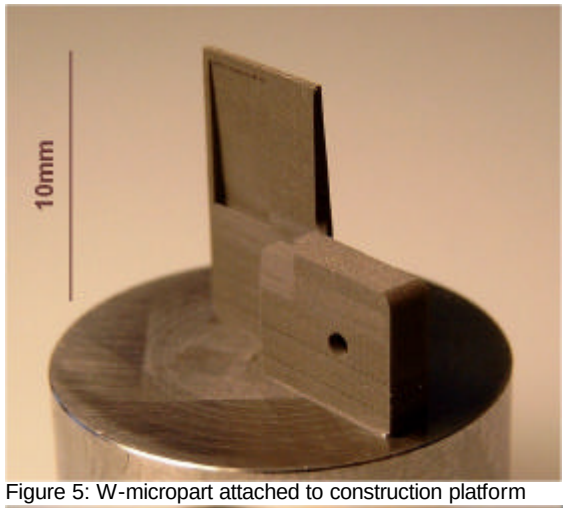


Figure 5: W-micropart attached to construction platform

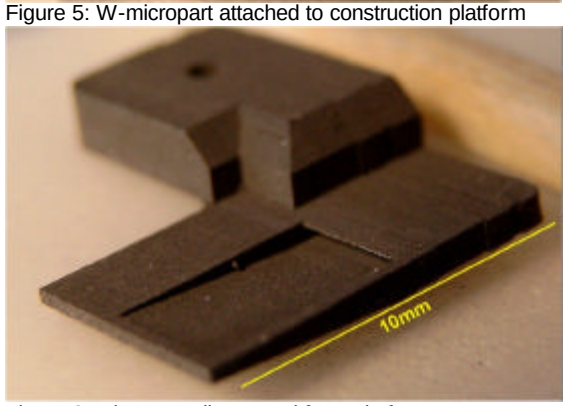


Figure 6: Micropart, dissevered from platform

A practically relevant micropart was needed with the special feature of a hidden hermetic channel, connecting a bore opening with a diameter of 1mm with a micro slit opening with the dimensions 400x3750µm^2. The specimen could not be produced in any conventional way without additional joining.
The novel laser-micro-sinter technology made it possible to generate the specimen over a height of 10mm free of distortion (Fig. 5 and 6). The specimen merely had to be cleaned by ultrasonification; further finishing treatment was not necessary. The measured roughness (Tab. 1) is presently unmatched and represents a new benchmark for SLS processes.

	horizontal	vertical	bottom surface
roughness R_a	5µm	3,5µm	7µm

Tab. 1: Roughness R_a of the respectively oriented surfaces

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/2/: R. Ebert, A.-M. Reinecke, P. Regenfuß, S. Klötzer, M. Nieher, B. Keiper, H. Exner: Generierung von Mikrostrukturen mit Selektivem Vakuumlasersintern, Lasermagazin 4/2002, S.19

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