

FRAUNHOFER INSTITUTE FOR CERAMIC TECHNOLOGIES AND SYSTEMS IKTS

PRESS INFORMATION

Harder 3D-printed tools – Researchers from Dresden introduce new process for hardmetal industry

Extremely hard tools are required in forming technology, metal-cutting and process engineering. They are conventionally made by powder pressing. Although this achieves a high degree of hardness, it is often necessary to carry out a complex and therefore expensive post-processing. Additive manufacturing enables complex geometries, but has been limited in terms of hardness and component size so far. Researchers at the Fraunhofer IKTS in Dresden have now adapted the 3D printing process *Fused Filament Fabrication* for hardmetals. The development meets all requirements for the first time.

Hardmetals consist of the metal binders nickel or cobalt and the hard phase tungsten carbide. Until now, reliable cutting, drilling, pressing and punching tools have been extruded, injection-molded or produced using uniaxial or cold isostatic powder pressing. Complex or specific geometries, however, can only be realized with these processes at great post-processing expenses or not at all.

Additive manufacturing processes provide a solution. Binder jetting and thermoplastic 3D printing have already successfully been used at IKTS with selected hardmetal compositions. However, the metal binder content and the resulting hardness as well as the size of these components are limited.

Fused Filament Fabrication enables economical and individual production of even harder tools for the first time

The additive manufacturing process Fused Filament Fabrication (FFF), which originates from the plastics processing industry, was initially adapted for ceramics and composite materials at IKTS. "The material-efficient FFF also opens up interesting possibilities for the production of large, complex prototypes or special tools made of hardmetals," reports IKTS shaping expert Dr. Tassilo Moritz.

During FFF, 3D bodies are manufactured from a flexible, meltable filament. For decades, Fraunhofer IKTS has got a proven powder metallurgical expertise. Thus, it was possible to produce the filament required for the FFF from hardmetal powders with organic binders. Depending on the materials structure, a reduced grain size and binder content can be used to specifically increase the hardness, compressive and flexural strength of hardmetals. Dr. Johannes Pötschke heads the *Hardmetals and Cermets* group at IKTS and confirms: "The filaments can be used as semi-finished products in standard printers and, for the first time, make it possible to print hardmetals with a

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Hagener Symposium
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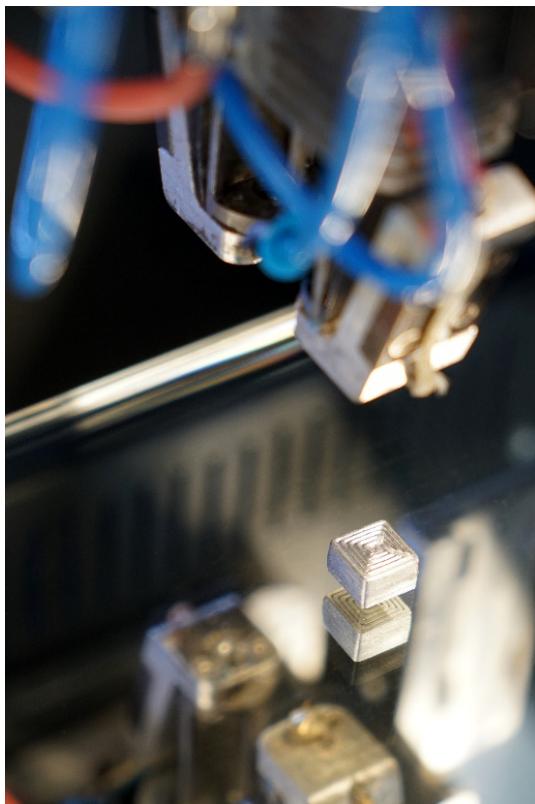
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very low metal binder content of only eight percent and a fine grain size below 0.8 micrometers and thus allow extremely hard components with up to 1700 HV10."

IKTS supports manufacturers and tooling experts in the selection of suitable materials and in the product-specific further development of 3D printing processes. The development will be presented at *EuroPM2018* in Bilbao starting on Monday.



Hardmetal sample with complex geometry on FFF standard printer Hage3D 140 L, in which larger components can be perspective printed as well.

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The Fraunhofer Institute for Ceramic Technologies and Systems IKTS conducts applied research on high-performance ceramics. The institute's three sites in Dresden and Hermsdorf (Thuringia), Germany, collectively represent Europe's largest R&D institute dedicated to the study of ceramics.

As a research and technology service provider, the Fraunhofer IKTS develops advanced high-performance ceramic materials, industrial manufacturing processes as well as prototype components and systems in complete production lines up to the pilot-plant scale. In addition, the research portfolio also includes materials diagnostics and testing. The test procedures in the fields of acoustics, electromagnetics, optics and microscopy contribute substantially to the quality assurance of products and plants.

The institute operates in eight market-oriented business divisions in order to demonstrate and qualify ceramic technologies and components as well as non-destructive testing methods for new industries, product concepts and markets within and beyond the established fields of application. Industries addressed include ceramic Materials and Processes, Mechanical and Automotive Engineering, Electronics and Microsystems, Energy, Environmental and Process Engineering, Bio- and Medical Technology, Optics as well as Materials and Process Analysis.