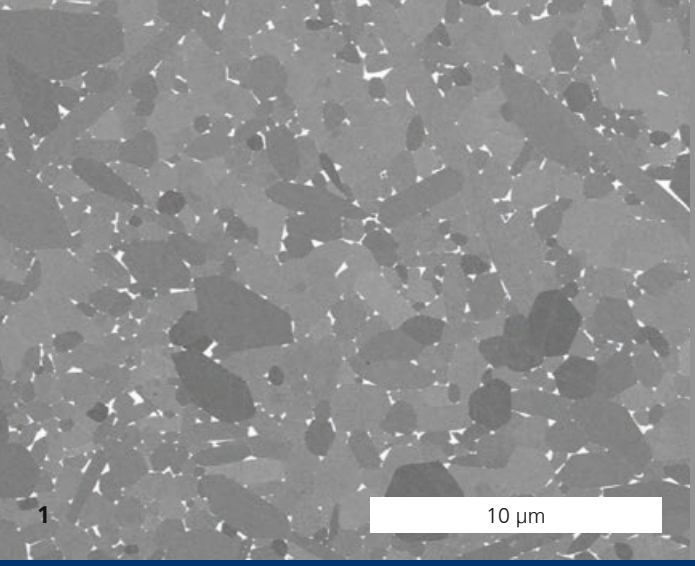


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# INTERCHANGEABLE CERAMIC HEADS FOR SINGLE-LIP DEEP DRILLING

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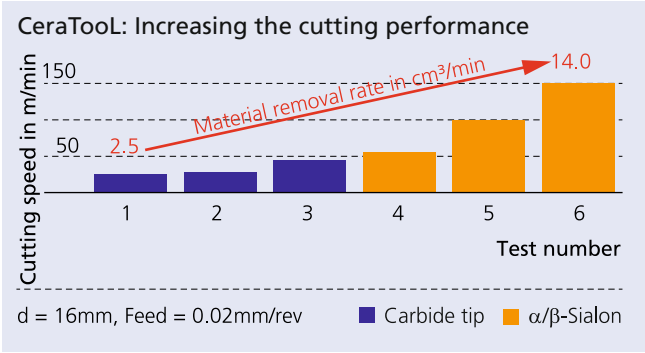
The use of high-tempered or hardened steels, new high-strength, high-rigidity and high-temperature-resistant non-ferrous alloys and composite materials in mechanical and plant engineering puts higher demands on the machining of materials. Several partners collaborated in the joint project CeraTooL to develop the use of ceramic high-performance cutting materials combined with a replaceable head system for single-lip deep drilling. This specialized drilling technique produces bores with large length/diameter ratios.

Special α/ß-sialon ceramic were developed for this process at Fraunhofer IKTS (Figure1). It has a strength of > 850 MPa, a toughness of 6.5 MPa√m and a high-temperature hardness of HV10 > 1400 at 1000 °C, enabling very effective machining. In order to develop ceramic-compatible contours for the cutting area of the replaceable heads and to test the performance of the ceramics, trials were initially carried out on indexable inserts. In several steps, suitable cutting edge geometries for the inserts and replaceable heads were designed, samples were machined on the 5-axis ultrasonic machining center and process parameters were developed for wet and dry machining. The functionality and performance of the indexable inserts were tested thoroughly on the AUERBACH AX1-TL deep-hole drilling machine with different workpiece materials. Taking the example of quenched and tempered steel 1.2312 (hardened 45 HRC), a significant increase in cutting performance could be demonstrated by tripling the usual cutting speed (diagram). Combined with a minimum quantity of cooling lubrication in the machining process, considerable energy and oil savings are achieved. These promising results for the indexable inserts served as the basis for producing optimized cutting edges for ceramic interchangeable drill heads. With the production of new ceramic interchangeable heads with an optimized cutting area (Figure 2), more experiments are to follow – not only with Sialon but also with a newly mixed ceramic grade based on titanium carbonitride, corundum and zirconium oxide.

**Services offered**

- Research and development of ceramic cutting materials
- Development of structural ceramic components

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1 *FESEM micrograph of the developed sialon ceramic.*
2 *Commercial single-lip drilling tool D = 16mm (top), Sialon drill head (center), drill head made of mixed ceramic with steel adapter (bottom).*


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