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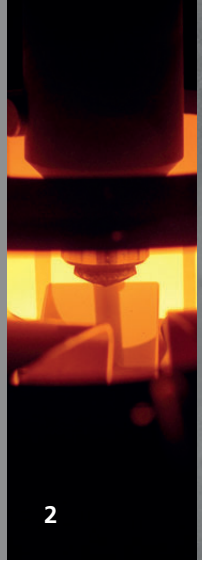

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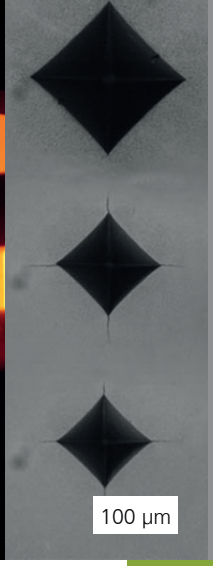

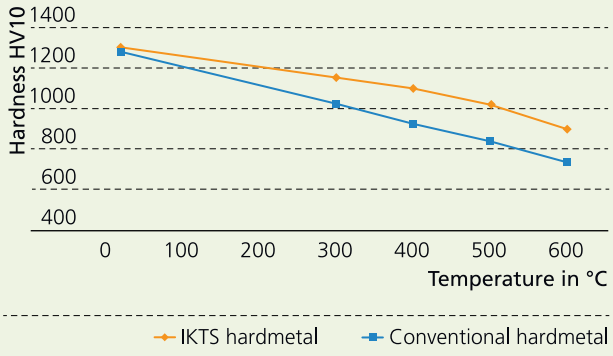

3

HOT HARDNESS TESTING OF THERMALLY STRESSED HARDMETAL TOOLS

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Fraunhofer IKTS develops innovative, wear-resistant hardmetals for cutting tools used in the machining of modern alloys and composite materials. The machining of titanium- and nickel-based alloys causes very high thermal loads on conventional hardmetal cutting tools. Despite active cooling, the cutting edge can reach temperatures of more than 500 °C, which greatly increases the wear on the tools and leads to higher machining costs. So far, solutions for wear-reduction have focused on tool geometry, inner cooling and CVD/PVD coatings.

The new IKTS approach consists in modifying hardmetals, especially the composition of binder metals and hard phases, to make them more resistant to higher cutting temperatures. In consequence, efficient machining and reduced tool wear are simultaneously possible and promote cost-efficient machining. An important instrument when it comes to quantifying wear resistance and comparing conventional and newly developed hardmetals is the measurement of the Vickers hardness in the temperature range between 300 °C and 900 °C. Compared with conventional hardmetals, which showed a significant decrease in hardness at temperatures above 400 °C, some IKTS hardmetals displayed a much better temperature resistance. Based on these findings, fundamental investigations were conducted as part of an SAB project (funding reference 100301902) to quantify the influence of the binder amount, the grain size of the tungsten carbide (WC) phase, the binder composition, and of additional hard phases. In a first step, model composites of adjusted WC grain size and binder composition were produced and tested. The newly developed hardmetals show a higher hot hardness in comparison with commercially available hardmetals with a medium WC grain size (Figure 2).

Further investigations to adhesion and oxidation resistance are being planned. In a next step, a first demonstration milling cutter with improved hot hardness will be tested.

Services offered

Development of hardmetals:
- With adjusted hardness to toughness ratio for a wide range of applications
- For high thermomechanical demands

Mechanical material characterization:
- Measurement of strength, hardness and fracture toughness from room temperature up to 1550 °C in air or in high vacuum
- Development of testing methods

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1 *Hot hardness test rig.*
2 *Hardness testing at 900 °C and Vickers indentations in WC-10 %CO at 20, 500 and 900 °C.*
3 *Comparison of hot hardness of hard metals.*

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