



FOREVER SHARP COOKING KNIVES DUE TO DIAMOR® COATING

THE TASK

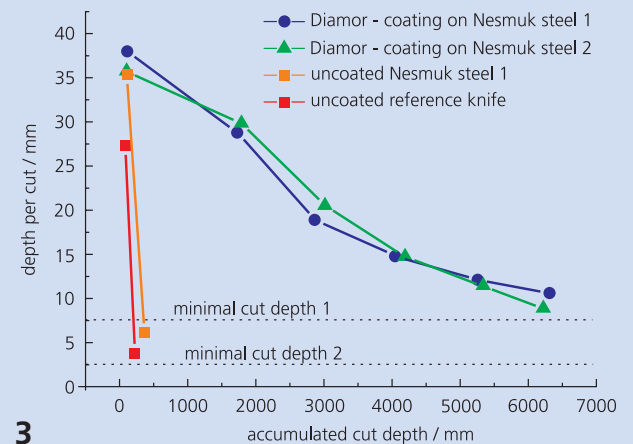
The fabrication of sharp knives is considered as an art of craftsmanship. Its origins can be traced back to the early middle ages. The oriental blades made from damask steel, a special multilayer material consisting of hard and soft layers are very famous. Modern high-end cooking knives are rarely made in damask steel technology. Instead equally strong monolithic steels are used. No matter how sharp a blade is ground, during use the sharpness rapidly drops to only a fraction of its initial value. It is critical for how long a knife can maintain an acceptable sharpness.

The coating of blades with thin CVD or PVD hard coatings is a promising approach to extend the sharpness for example of razor blades or technical cutting tools. Cooking knives applications however have so far not been convincing. The Fraunhofer IWS ta-C Diamor® coatings offer a great potential for this application. They are very wear resistant so that a very thin layer protects the cutting edge very well without addition too much curvature to it. The approach was tested with the goal to substantially extend the cutting live of high-end Nesmuk knives. An additional objective was to generate an attractive design of the blade, which is hollow ground on both sides.

OUR SOLUTION

A previous research project funded by the FGW (Research association for tools and materials e. V.) indicated that a double sided coating of a blade with ta-C would not yield substantial improvements. However, a single sided application helped to drastically reduce the loss of sharpness. A film thickness of 3 µm appeared to be optimal. The by the FGW employed testing specification DIN EN ISO 8442-5 is based on the repetitive cutoff of paper card stacks. The number of severed cards per cut represents a measure for blade sharpness.

FGW test for a cooking knife by cutting paper stacks
 minimal cut depth:
 1 requirement for knives that are not to be resharpened
 2 requirement for knives that are to be resharpened



The experiment involved four knife blades. In addition to the reference knife (test winner of a well-known testing institute) we tested an uncoated Nesmuk knife (1.4153) and two with 3 µm Diamor® coated Nesmuk knives made from different steels (1.4116 and 1.4153).

RESULTS

The results plotted in the diagram show a significant difference in cutting performance for the uncoated and the Diamor® coated blades. The uncoated blades turn dull within a short time and have only a fraction left of the initial sharpness. On the other hand both Diamor® coated blades maintain an acceptable sharpness for an extraordinary amount of time. An acceptable sharpness means for not-to-resharpened knives a cut depth of 7.5 mm, and 2.5 mm for knives that have to be resharpened. Both Diamor® coated knives maintain values above both specification even after a total cutting length of 6 m. Based on these results Diamor® knives can be basically considered to be indefinitely sharp.

To meet the design requirements was a technological challenge. The coating had to be applied in form of a narrow strip along the edge while all other surfaces should remain free of coating. To meet these requirements a special fixture was designed and built, which also ensures high quality coating capability for larger quantities and process reproducibility.



- 1 Mask fixture for exact contour coating of the knife blade
- 2 Coated blades

CONTACT

Dr. Volker Weihnacht
 phone +49 351 83391-3247
 volker.weihnacht@iws.fraunhofer.de

