IHI Bernex is pleased to announce the next generation of chemical vapour deposition (CVD) coatings for carbide-based cutting tool applications. This coating family is based on a proven multi-layer structure: a layer of highly structured α-aluminium oxide (α-Al₂O₃) on top of a layer of titanium carbo-nitride deposited at medium temperature (MT-TiCN), combined with specific pre- and post-treatments of the cutting tool.

In this article, we will show that this new generation of coatings can make tools for cutting operations last much longer than the reference coatings.
Textured Multilayer Coating Architecture

Michael Auger, CEO of IHI Bernex, says: “We began with the desire to be able to tailor the multi-layered coating structure to the specific demands of the cutting application, either continuous turning or interrupted cutting. With this idea, we have developed several different variations of the coating.” A typical cutting application requires a thick layer of the columnar MT-TiCN, to provide the necessary level of wear resistance. The IHI Bernex process engineers were able to then apply a highly textured α Al₂O₃ layer on top of the MT-TiCN layer, to maximise the tool’s performance for continuous turning or interrupted cutting.

By including the correct interlayers between the MT-TiCN and the α Al₂O₃, IHI Bernex coating engineers created new transition layers and the ability to texture the crystallographic orientation of the α Al₂O₃ coating. This allows them to tailor the crystallographic benefits of the CVD coating to the final application. In many cases, this crystallographic texturing coefficient as measured by X-ray diffraction is greater than 8. The figure below shows an example of an α Al₂O₃/MT-TiCN multi-layer.
**Pre- and Post-treatments that Elevate Coating Performance**

A great coating alone is not enough. It needs to be paired with the right cutting tool design, the correct carbide powder grade, and the tool preparation (pre-treatment) and after-coating process (post-treatment) steps to further improve the coating performance. The development of this coating, therefore, also included developing the specific pre- and post-treatment.

This fits the way IHI Bernex provides solutions. Michael: “We have the knowledge and tools in Olten, Switzerland, to offer our customers the complete package, so we did. Through diligent tuning of the coating and treatment factors, we were able to achieve superior performance compared to the reference coatings.”

**Interrupted Cutting Test Results**

To test the effect of the new coating, IHI Bernex compared inserts coated with the CVD reference coating, the reference coating with pre- and post-treatment, the new generation of coatings with only the post-treatment and the new coating with both the pre- and post-treatment. For interrupted cutting of CK45 tempered steel, the new generation of coatings with the proper pre- and post-treatments led to a dramatic increase in tool life (see below). Whereas the comparable reference coating failed after 15 minutes, the new generation of coating surpassed 45 minutes of tool life.

**Continuous Turning Test Results**

For continuous turning of alloyed steel, IHI Bernex compared a different variation of this next-generation coating with the reference coating. On the next page, you can see, as measured by flank wear, the tool life is again greatly improved. After 8 minutes of continuous turning, the reference tool is already exhausted.
which is defined at 0.2 mm of wear. The tool with the IHI Bernex next-generation CVD coating tool only reached the exhaustion point after 25 minutes.

**Looking Ahead to the Next Great Development**

Hristo Strakov, IHI Bernex Head of Technology, places the new coating in context of the IHI Bernex approach: “We are continuously improving our CVD coatings, often guided by customer and market requirements. The recent innovations in our coating equipment have allowed us to achieve these phenomenal results. But I don’t think we will ever be finished. We continue to be approached for applications with even higher demands and requirements, and we aim to answer that challenge.”

Are you interested in including these superior CVD coatings in your product offering and helping your customers extend the lifetime of their tools?

The Bernex sales team is ready to answer your questions and to work together to come to the right solution for your portfolio.

Contact Daniel Schranz (Daniel.Schranz@ihi-bernex.com or +41 79 292 43 89) or Philippe Ricklin (Philippe.Ricklin@ihi-bernex.com or +41 79 330 29 59) for more information.

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**CONTINUOUS TURNING TEST**

![Graph showing continuous turning test results](image)

**Cutting conditions**

<table>
<thead>
<tr>
<th>Material</th>
<th>Vc (m/min)</th>
<th>Ap (mm)</th>
<th>Fn (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34CrNiMo6</td>
<td>220</td>
<td>2</td>
<td>0.2</td>
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</tbody>
</table>

**Reference coating**

**TC006-V1**

Turning of tempered steel with CVD-coated inserts