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hp tooling



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Machine Tools, PCD, PVD, CVD, CBN, Hard Metal

drehehen

Oberflächen wie geschliffen –
mit polykristallinem Bornitrid

drebonid[®]-G

unentbehrlich für
Werkzeugbau und
Produktion



**LACH
DIAMANT**



**HSS-Guß-
hochlegierte
gehärtete Stähle**

ab 55 HRc



This cover picture is a reproduction of a leaflet of 1975.

"Poly - poly - or what?"

3rd part

How grinding times of hours became turning times of minutes ...

“Poly – Poly - or what?” Third Part – Hard Turning.

How grinding times of several hours became turning times of a few minutes...

Horst Lach, managing director and CEO of LACH DIAMANT agreed to write an ongoing series of articles about the development of diamond and CBN tools and grinding wheels in modern industries.

Horst Lach is known as a true industry veteran, and we are excited to have this pioneer of technology share some insights from over 57 years of professional experience in the diamond tool business.

In the fifth part of this (almost) historical review, Horst Lach looks back to the very beginnings of hard turning.

We are in part three of our article series “Poly – poly – or what?”, looking back at the time between autumn 1974 and the Hanover Trade Show in the spring of 1975.

Dealing with this new cutting material “polycrystalline diamonds” (PCD) was fascinating for all of us; after the presentation at the first Hanover Trade Show in 1973, each day brought new insights for production and for different applications. The diamond cutters – familiar with the production of natural turning diamonds and polished turning diamonds for the jewellery industry and for the turning of copper commutators - were especially amazed by the superior cutting abilities of this new material in comparison with natural diamonds. Two examples: Interrupted cuts, almost in all cases disastrous for natural diamonds. PCD allows for high feed rates up to the cutting width (even for the now available “large” PCD cutting edges), while natural cutting edges only allow for a range within μ - or up to 1/100 mm for selected materials.

Despite this fact, or now more than ever, development, production and application of the first PCD tools was successful in the end; it was a team effort and based on the professional know-how of diamond cutters such as Konrad Wagner, a master of natural diamond grinding who unfortunately died much too early, and Gerhard Mai with the assistance of machining expert Kurt Hemerka (grinding wheel production).

Polycrystalline diamond materials resisted even the most artistic skills of natural diamond cutters on traditional cast grinding wheels (“poly” means “much” and does not have any growth to guide the trained eye of a diamond cutter). A grinding test on a resin-bond grinding wheel, manufactured by LACH DIAMANT, proved to be so successful that we started to look for a stable and precise tool grinding machine. We found a machine manufactured by Kelch which we co-developed especially for PCD grinding. After a license transfer, we continue to build the »pcd-100/300« precision tool grinding machine for single-tipped PCD and carbide tools (see also “Poly – poly – or what?” part 1 and 2).

All this obvious excitement, only one and a half years after the first PCD introduction in 1973, brings to mind another great innovation. “Start with Borazon®”, the abrasive of a new era, had been presented at Hanover Trade Show in 1969. Borazon® CBN grinding wheels from LACH DIAMANT are so well known among tool grinders in the tool manufacturing industry - as tool and inside grinding wheels with increasing production, as peripheral grinding wheel for surface and circular grinding - that the name “Borazon” is clearly associated with

first part) I had expected a polycrystalline CBN cutting material back in the beginning of 1973 – a sort of “compact Borazon cutting edge”.

Moscow beckons with a new cutting material “Elbor”

As luck would have it, we received an inquiry from Hempel company, Düsseldorf, which had good business contacts to Moscow, and they asked whether we would be interested in a new cutting material named “Elbor” manufactured in the USSR, a compact CBN material, compressed through high-pressure synthesis.

Of course, yes! Electrified - that would be an understatement. And so it happened that Konrad Wagner and I flew to Moscow from East Berlin in 1974, in a Tupolev – first class as VIPs, organized by Hempel.

The impressions and experiences of this short trip right before Christmas, to an, at that time, unknown world for us – would be worth a separate report. We found out that we got to Moscow at the invitation of the Russian Ministry of Food & Agriculture. This government department supervises 15 high-technology institutes/manufacturers for synthetic diamonds and CBN.

At that time, we visited the “Tomilinsky Factory” near Moscow, founded in 1959, and according to their own accounts one of the leading manufacturers of diamond tools in the former Soviet Union, and from the 60’s onwards also a manufacturer of diamond and CBN grains. Here we should get to know “Elbor”. A “new” cutting material, until then unknown in the Western world, designed to make machining tools for hard machining.

By that time, we were very familiar with Borazon CBN grinding wheels, made from high-alloy hardened steel from 58/62 HRC. Compared to grinding, it should be easy to use this CBN composite mixture (unlike diamonds stable up to 1.500° C) for the superior turning of these steels. In this context, the reference to PCD, the polycrystalline diamond of General Electrics.



LACH DIAMANT.

“Borazon” was there something else? As I remember (see “Poly – poly – or what?”

However, the CBN composite material named "Elbor" consisted of a unit with an 8 mm radius and a thickness of approximately 6 mm. There was no carrier – or carbide layer, which would have provided for a solid soldered joint. We found comfort in the thought that we would – as usual – find a solution in order to achieve a stable connection between "Elbor" and holder.

A license contract for the raw material "Elbor" was signed. Unfortunately, on December 22nd, shortly before our flight back, we had to cancel a visit to the top secret "Institute for Super Hard Materials V Bakal" in Kiev/Ukraine. We had an invitation from the ministry, and they would have even taken us by helicopter to this research facility, with up to 1000 employees.

Unexpected Help by Coincidence

Back in Hanau, we started our first preparations for the Hanover Trade Show in 1975. What should we do with "Elbor"? We received unexpected help by coincidence, sure enough via Borazon®: A "customer problem" in regards to surface grinding a metal powder coated cylinder. The customer thought that grinding times with the CBN grinding wheel were too long. "Well, let's try this compact CBN »Elbor«."

Thought – and done. However, as expected, soldering without a carbide holder, as with



First presentation in Hanover in 1975 – Hard turning instead of grinding.

cutting edge. The first attempt of making a turning tool in this way was already successful.

"This will be our trade show highlight – we will demonstrate it on a Weiler turning lathe". And so it happened: At Hanover Tradeshow in the spring – the "new" product was successfully presented as "dreborid G-AS" for machining of metal powder coated turning parts. For the first time, hours of grinding times were reduced to minutes of turning times – and the

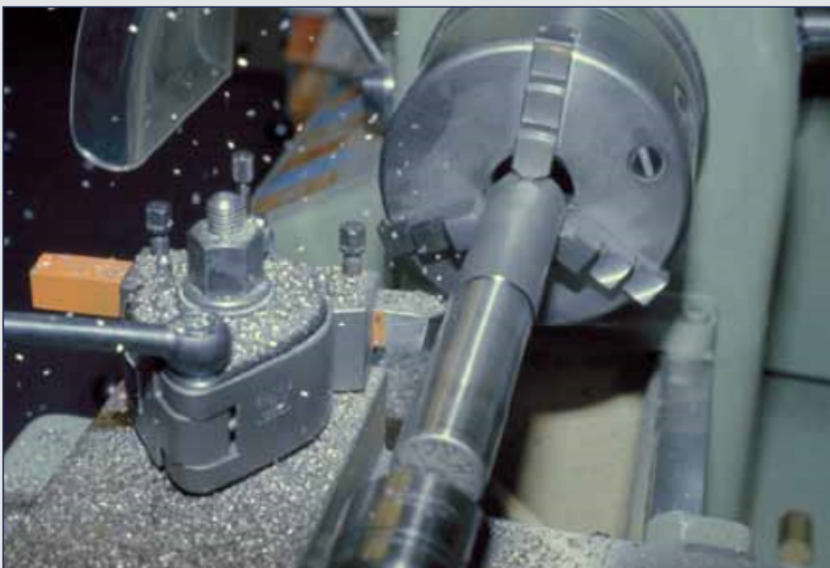
The first step towards better performance and more efficiency was done. At first it was only a niche market; mainly Metco (today Oerlikon-Metco) and Castolin, among other manufacturers for metal powder coatings, considered the dreborid-G-AS turning tools almost as a gift. Too many customers complained about long grinding times during the equalisation of flame-sprayed turning parts with nickel, chrome and wolfram carbide alloys – no matter whether for repairs or wear protection. Right away, we achieved up to 90 percent reductions – turning instead of grinding (as mentioned in MM Maschinenmarkt, issue #3/April 1976).

The Search for Other Possible Applications

During the initial phase, Metco and Castolin provided all their technicians with LACH DIAMANT developed repair kits, containing one dreborid-G-AS turning steel and a special development, a dreborid G-diamond grinding wheel. Due to the low hardness of CBN – compared to PCD – even inexperienced tool grinders were now able to re-grind the cutting edge.

Encouraged by these first experiences and during our search for other possible applications, we were inspired by the positive experiences during the use of Borazon® CBN grinding wheels. In fact, both procedures – grinding and turning – could handle materials like high-alloyed hardened steel with a hardness of 58 and 62 HRC.

We realized that from now on, there would be a "gap" between grinding with CBN and



dreborid-G-AS during machining of a metal powder coated steel part.

PCD, was unsuccessful. At that time, we did not have the option to solder within a vacuum, and so we had to sinter the "Elbor" surfaces were just as polished.

machining with polycrystalline CBN cutting materials results – despite of continued attempts of machining tool manufacturers to counteract this tendency with newly developed types of carbides and ceramics.

The Alternative to Elbor

The readers will likely assume that the first successful attempts during hard machining were owed to the imported CBN cutting material named “Elbor” – but with the initially worried-about disadvantage. A solid carbide basis for soldering was missing from the 8 mm Ø CBN compact unit. More and more often, we ran into the problem that the “precious” Elbor cutting edge would break out of its matrix after 30 to 35 percent usage.

There was no other alternative manufacturer of polycrystalline CBN cutting edges. Until the end of 1975, when our PCD supplier GE surprisingly informed us that we could order polycrystalline “BZN-compact” boron nitride cutting edges from GE – with a carbide basis for soldering. Without any hesitation, we switched to “BZN-compact”.

Apparently, this polycrystalline material had already been developed in the mid 60’s, in order to offer it to GE subsidiary Carbology. They were not interested at the time and did not want to have anything to do with products “superior to carbide”. That is how Louis Kapernaros (at the time General Manager at GE – Super Abrasives, Worthington, Ohio/USA) described the situation years later when we had become very good friends.

The punch line in this regard: When we presented CBN tools at the Hanover Trade Show in 1975, Carbology in Frankfurt had already BZN inserts in their safe for some time...

All told, once again the first step to the introduction of a new technology had been taken – let’s simply call it the “hour of birth of hard turning”... **Horst Lach**



Enthusiastic responses and amazement during the first presentation of dreborid-G-AS.



dreborid-G-AS during turning of a metal powder coated steel part.