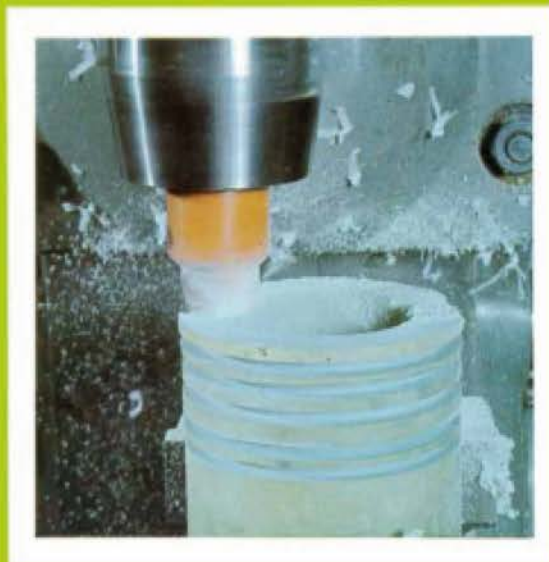


**LACH-DIAMANTEN**  
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Entwicklungsstand 1974  
This title is the original  
cover picture of a catalogue -  
stage of development: 1974

***"Poly - poly - or what?"***

4th part

How a trade show initiated a brilliant idea...

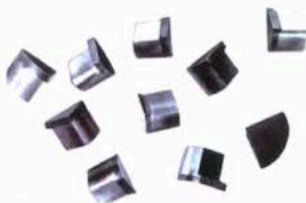
# "Poly, poly or what?"

## How a trade show initiated a brilliant idea

In the next part of this (almost) historical review, Horst Lach recalls a brilliant idea. Between 1974-1976 polycrystalline cutting materials diamond (PCD) as well as CBN (PCBN) could show their potential for the first time. As a result of the hardness of diamond combined with the sharpness for machining tasks, the superiority of PCD was displayed early on turning, milling, drilling and cutting. Nevertheless, this particular cutting material was at that point still a niche product. The world of global players within the automotive industry had not yet discovered it or had not yet realised its cost-cutting potential. There were several reasons for this.

When the polycrystalline diamond was first introduced to the industry in 1973, tool manufacturers had only been able to grind carbide, a similar cutting material, efficiently in a cost-effective way for about five years. Again, diamonds, to be more exact the grinding wheel that was available for carbide cutters at the time, played a role in this.

Until around 1967, diamond wheels were only referred to as polishing wheels, and therefore not suitable for pre-grinding processes. The reason for this was that the synthetic and natural diamond grains in resin-bond grinding wheels would fall out of the bond after approximately a third of their product life. Only after the diamond grains were coated with nickel cobalt, an innovation of the company Asea, was it possible to create a lasting, coralline surface connection between the resin bond and the individual diamond grains. Pre-grinding of carbides was now possible and initiated a



Unmachined synthetic cutting inserts - developmental status as of 1973. The shown segments with 60° and 90° angles were mechanically cut out of PCD blanks (of approx. 3.4 mm) with diamond cutting wheels

boom-like upswing of the carbide industry. It could be questioned whether polycrystalline cutting materials came too early for the industry.

### PCD - too early for many

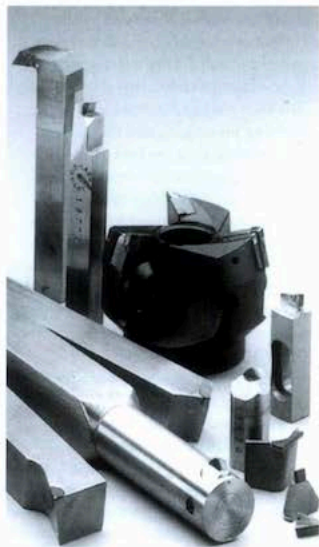
At the beginning of the 1970s, turning machines with microprocessors for CNC production did not exist and first attempts were made about 1978. Until then, turning was mostly done manually, outside of a few exceptions with perforation stripe controls. For the carbide industry, especially for the booming manufacturers of carbide tools, the synthetic and at the time still controversial diamond material PCD definitely came too early.

In the early to mid 70s, the question was what to do with a cutting material advertised by manufacturer General Electric as a performance-enhancing material for machining non-ferrous metals. The "hard metal" cutting material had only recently been "defeated". With non-ferrous metals, where were the potential customers asking for a cutting material for machining of aluminium, superior to carbide and with a much longer tool life? At the time, there was no automated production, as microprocessors were not introduced into the world of machining until 1978, with one of the first turning machines. The material aluminium had to wait some time until its successful breakthrough into the world of motor manufacturing, in other words mass production of automobiles.

The grinding of natural diamonds was not only complicated but also, and even more so, was the grinding of "non-growing" polycrystalline diamonds. Therefore, the diamond experts were expected to deal with this "exotic" PCD.

LACH DIAMANT concentrated more and more and with increasing interest on this new cutting material. Due to our decades long experience in manufacturing and service of turning tools, made of natural diamonds, for overturning copper commutators, for customers like Bosch, Siemens and AEG, we were made aware of manufacturing problems during the production of raw commutators and the solution found in PCD.

PCD tools had been developed based on



Soldered PCD mount for external and outer turning and boring as well as for cutter heads

the earliest requirements and focused on the use of turning tools with soldered cutting segments with 60° or 90° angles.

Even though milling with PCD was already a highlight of the Hannover Trade Show in the spring of 1974, at the end of the 70s it was still limited to carbide plates which were clamped into cutter heads. They consisted of a soldered PCD cutting edge and small shank tool with at the most three cutting edges.

All available PCD cutting edges had to be tediously cut out of a 3.4 mm, or at the end of the 70s, a 6.4 mm blank, which left only little scope for spectacular depth or width of the cuts. Furthermore, the prevailing textbook opinions about diamonds were still in too many heads. Diamond was considered only suitable for polishing gold, silver and some non-ferrous metals, but not suitable for uninterrupted cuts. This was another obstacle during the market launch of polycrystalline cutting materials.

### Convincing at productronica

The announcement of a show which was



until then unknown to me, proved to be a turning point for the implementation of polycrystalline diamond tools.

productronica 1977 in Munich was announced as a component show for the electronic and circuit board industry.

The basic material used for circuit boards was glass fibre reinforced plastic (GRP). We had successfully cut this with PCD, even dust-free. In order to demonstrate this successfully at the trade show, a demonstration machine was needed. We found it at former AEG in Seligenstadt where they manufactured circuit boards for domestic use, with a Swiss machine from manufacturer Amacher. Three processes could be shown on this small HAMBA precision machine: cutting, scoring and edge machining. Excellent. We registered for the show. We placed an internal work order for the three PCD tools or rather saws we needed.

The only objections were raised by production: "How are we supposed to grind these rotating tools. It will take forever!" Indeed, to finish 12 teeth, for example, it took 35 hours of grinding time. But I reminded them that they had always found a way in the past.

productronica 1977 was at first a huge success for LACH DIAMANT. At the time, there was a growing demand for electronic circuit boards and all the big names were present and gathered around the small Amacher machine to marvel at the precise, highly accurate and dust-free machining of

PCB, the basic material of circuit boards. I still remember to this day, the experts at Siemens and NCR who immediately thought of diamond saws for packet machining of 300 and 350 mm  $\varnothing$ , and who spontaneously ordered samples for further experiments.

It could have been so perfect. Machining of circuit board materials would have been possible in a more efficient way since then if only production has not said that they could either make scorers and saws for circuit boards or continue to serve customers like Bosch and Kautt & Bux with commutator diamonds.

That was it for rotating PCD tools. This grinding technology delivered only 12 PCD teeth in 35 hours. The initial trade show success was gone. The real culprit was the beastly polycrystalline "non-growing" diamond material itself and even diamond cutters with years of experience capitulated.

#### The turning point

Then, suddenly at the end of 1978, a second turning point would finally lead to success. Once again via an announcement, this time in a sales advertisement for a spark erosion machine by the company MATRA in a Frankfurt newspaper.

I had never heard of it. A spark erosion machine? But I did remember my father mentioning that electricity played a role during the cutting of natural diamonds on the obligatory cast discs.

We had a good relationship with MATRA Frankfurt, at the time a manufacturer of



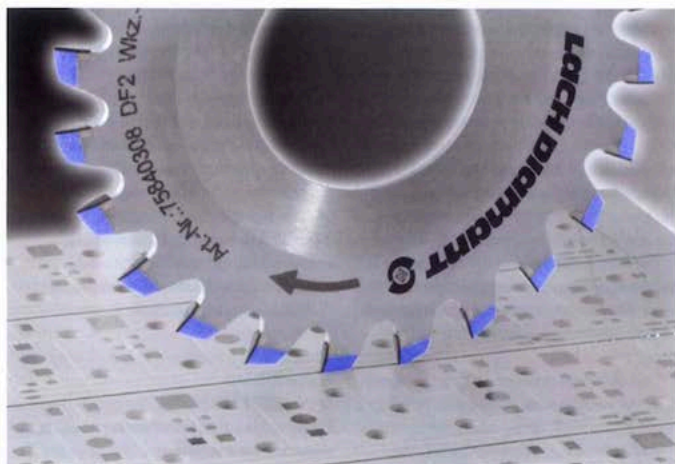
1977 at productronica in Munich - the worldwide first demonstration of PCD cutters, saws and scoring saws for PCB circuit boards on an Amacher precision machine, type Hamba

"state-of-the-art" surface grinding machines. LACH DIAMANT was permitted to use these machines especially for experiments with CBN Borazon grinding wheels.

On visiting the MATRA facility, we stood in front of a machine that I would call some sort of "sinking machine. The PCD sample we handed over for the "spark test" was carefully mounted and disappeared in a "brew" which I now understand as a sort of dielectric. We took turns to examine the changes with a magnifying lens. Nothing happened, not even during the next five minutes. We were already on our way out of the hall, when I suddenly discovered another machine in a corner. It looked slightly different, mainly because of an additional "tower-like" structure. As we were already there, we mounted the sample on the FANUC machine and it worked right away. The hot wire actually cut the promised profile out of the PCD and formed it.

This visible success surpassed all our expectations. The experiment had shown us how to produce profiling tools and mills under the influence of spark erosion, a discovery that would show its full value for the future only two weeks later, but first of all I had to visit our patent lawyer on the next day. The patent number 0010276 "Herstellung beliebiger Profile in polykristallinem synthetischem Diamant mittels Funkenerosion" was granted and published on April 21st, 1982, as one of the first European patents.

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LACH DIAMANT «DreboBlueCuts» PCD Scoring Saw - developmental status as of 2018 - "World Running Champion" not only during PCB machining but also (as shown in the photo) during the scoring of aluminium IMS circuit boards