

*Coatings for tools in machining and finishing*



# THE SMART COATING FOR MACHINING & FINISHING

DIAFIN® layers for improving the properties of tools in machining and finishing



## THE MOST IMPORTANT PLUS POINTS:

- + The optimal solution for tools
- + Suitable for machining and finishing
- + Thin layer system ( $< 20 \mu$ )
- + Long service life and regenerable
- + Free design for cutting performance





SOLUTION EXAMPLES

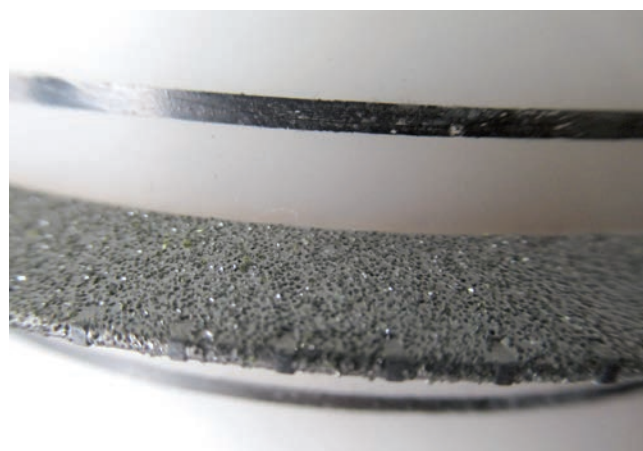
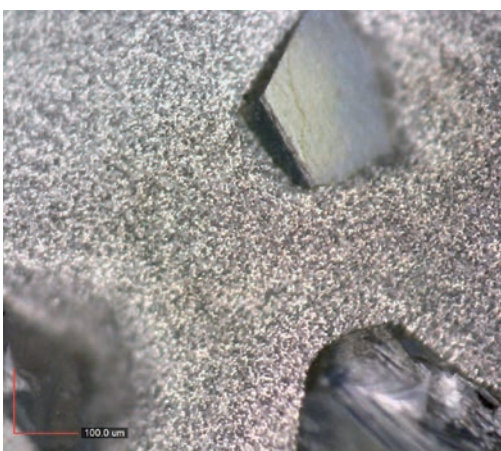
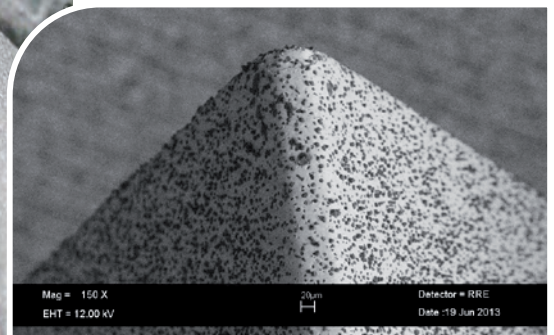
# THERE IS ALWAYS A PERFECT SOLUTION

The requirements are different for each surface. Our coating process is flexible and has an adjustable degree of hardness. We adapt to your needs. Please feel free to get in touch.

Further information about how DIAFIN® works can be found here or at [www.cct-plating.com/diafin](http://www.cct-plating.com/diafin)



**DIAFIN®** coatings based on diamond and CBN particles are suitable for use in cutting tools.



Cutting tools with Diafin coating. Large grain sizes (200 - 500 µm) in combination with small grain sizes (2-15 µm).

Particle sizes from 2 - 500 µm for use from finishing to machining.

## AT A GLANCE

### TYPE:

Dispersion coating based on nickel and nickel-phosphorus

### PROPERTIES:

- > Wear-resistant layer for machining and finishing
- > Adjustable hardness of the nickel-phosphorus layer (approx. 550 HV0.1 to approx. 1,100 HV0.1).
- > High corrosion resistance
- > Perfect contour accuracy or very uniform thickness with electroless nickel
- > High layer thicknesses when using electroplated nickel

### USE:

For coating of machining tools

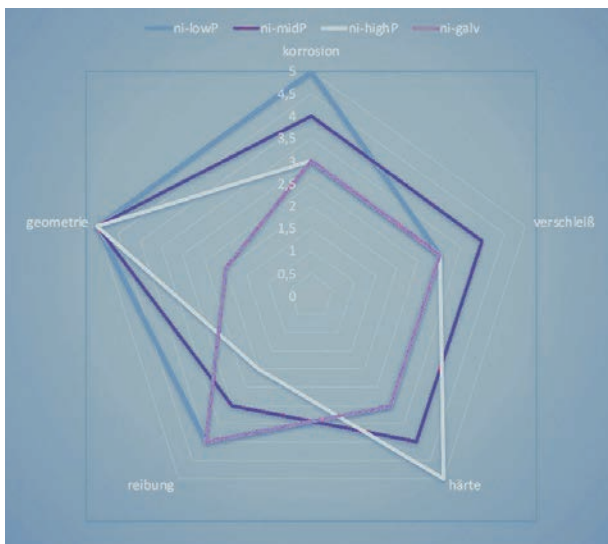
### COATING CHARACTERISTICS:

Nickel-phosphorus layer from approx. 5 µm to approx. 22 µm with dispersion materials  
Particle sizes from 2 µm - 500 µm

### SUBSTRATE CHARACTERISTICS:

The substrate material must be suitable for electroplating to achieve the very good adhesion of the coating to the substrate.

## ADVANTAGES OF USING DIAFIN® COATINGS



Overview of all advantages in the network diagram

- + The optimal solution for tools
- + Suitable for machining and finishing
- + Thin film system (< 10 µm)
- + Thick film system (< 500 µm)
- + Long tool life and re-claimable
- + Free choice of cutting performance
- + Wide range of applications in almost all types of tools
- + Cost reduction compared to conventional tool materials
- + Can be used without design changes
- + Easy handling

The **DIAFIN®** dispersion coatings based on nickel and nickel-phosphorus are characterised by the fact that they combine several important properties, or rather that the properties can be adapted to the requirements of the application depending on the composition and/or heat treatment. This can be illustrated by means of a network diagram for qualitative evaluation, on the basis of which the user can select the required properties.



### APPLICATION

Tools for the mechanical processing of metallic and non-metallic substrates must have good resistance to friction and wear, combined with a certain degree of corrosion resistance to various environmental influences. Nickel and nickel alloys, in particular, meet these challenges to a high degree.

The **DIAFIN®** coating system is the solution for creating surfaces on tools for machining and finishing materials. Depending on the surface requirements, the **DIAFIN®** coating is based on an electroless nickel-phosphorus alloy or electroplated nickel.

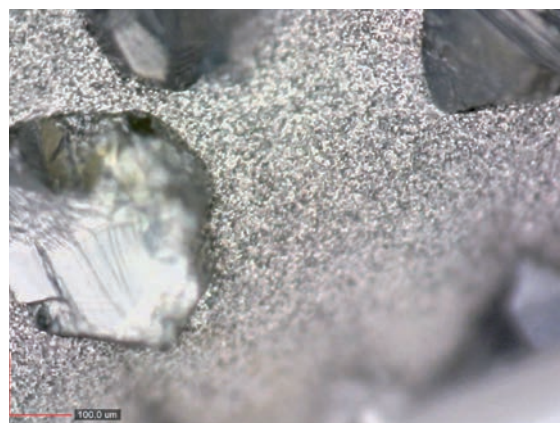
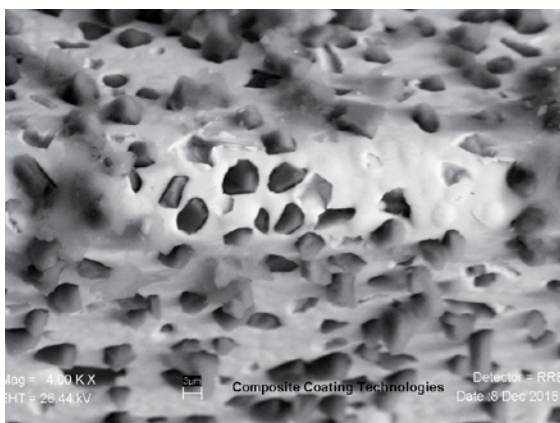
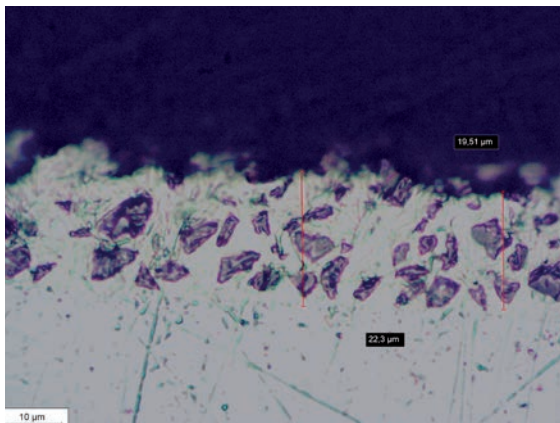
The hardness and, above all, the friction and wear properties can be adapted to the respective task within a wide range through the incorporation of dispersion substances or heat treatment. The hardness of a **DIAFIN®** coating can be adjusted to values between approx. 550 HV and 1,100 HV by using electroless nickel-phosphorus, depending on the phosphorus content and post-treatment. For the **DIAFIN®** dispersion coatings, mainly cubic boron nitride (cBN) or diamond are used as embedded particles. The layers are deposited in thicknesses of about 10 µm to several hundred

micrometres. In addition to a good mechanical stability, the coatings are also characterised by a very high resistance to corrosion.

- Typical applications for **DIAFIN®** coatings are:
- > Pulling or dressing tools for gauges for threads or fits, limit plug gauges
  - > Drills, reaming or honing tools
  - > Tools for grinding, finishing and super-finishing
  - > Belts for grinding or honing.

**DIAFIN®** coatings are suitable for further conditioning. For example, the application of an additional **DIAS-HIELD®** layer in a thickness between 3 µm and 20 µm reduces the surface roughness and optimises the running-in behaviour.

Schematic



Schematic illustrations of the **DIAFIN®** system

## CHARACTERISTIC VALUES FOR DIAFIN® COATINGS

In the case of a **DIAFIN®** dispersion coating, the thickness of the nickel layer is selected in such a way that the particles (e.g. cBN and diamond) are reliably incorporated homogeneously in the coating.

The required layer thicknesses are listed in the following table.

Functional properties	Friction value increasing diamond coating <b>DIAPROTECT®</b>		
	<b>DIAFIN®</b>	<b>DIAFIN®</b>	<b>DIAFIN®</b>
Designation			
Average particle size	2 - 10 µm	11 - 250 µm	250 - 500 µm
Coating rate	15 % to 60 %	15 % and 60 %	15 % and 60 %
Layer material	Electroless nickel-phosphorus or electroplated nickel or nickel-phosphorus		
Hardness of coating matrix	550 – 1.100 HV0,1		
Layer thickness of the matrix (electroless nickel)	5 - 50 µm	11 - 250 µm	250 - 500 µm
Layer thickness of the matrix (electroplated nickel)	up to several hundred microns		

A characteristic value for the properties of the coating is provided by electrolessly deposited nickel (if used) with phosphorus contents between 1 % and up to 13 %, available in three forms:

- > **Low phosphorus content** – 2 % to 5 % / high deposition hardness / lower corrosion resistance
- > **Medium phosphorus content** – 5 % to 10 % / medium deposition hardness / higher corrosion resistance
- > **High phosphorus content** – 10 % to 13 % / lower separation hardness / high corrosion resistance

The phosphorus content determines the basic hardness of the nickel layer, the achievable maximum hardness with the application of a temperature treatment and the corrosion resistance.

## PREREQUISITES FOR DIAFIN® COATINGS

The substrate material must be suitable for electroplating in order to achieve very good adhesion of the coating to the substrate. The suitability for galvanic coating with **DIAFIN®** must be clarified with the client. In addition, the substrate must have sufficient load-bearing capacity to prevent excessive deformation and the resulting high mechanical stress (in extreme cases up to mechanical destruction) of the coating.

When using a **DIAFIN®** dispersion coating, the interlocking between the hard materials (e.g. cBN and diamond) of the coating (nickel or nickel-phosphorus) and the surface of the component is determined by the surface hardness of the substrate. A higher surface hardness may make it more difficult to seed the substrate surface (i.e. to produce an even and well-adhering nickel dispersion layer). A lower surface hardness increases shearing (in the form of material wear) of the component's material and thus the occurrence of (friction) wear.