



# New generation of ta-C coating machines for PCB microdrills



# Swissnanocoat SA/Creepservice Sarl

SNC ta-C coating (tetrahedral amorphous carbon, without hydrogen) is ideal for PCB micro tools.

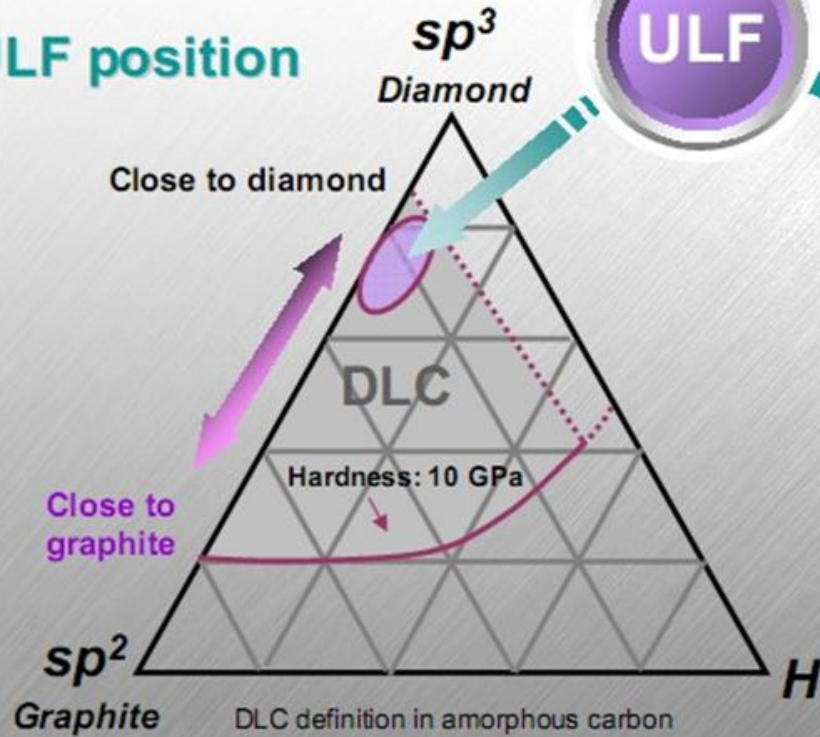
Union Tools , Japan, successfully applied SNC coating technology developed by SwissNanocoat /Creepservice, SWITZERLAND , called ULF (ultra low friction) during more than 13 years under temporary license.

Now Swisanocoat Co presents new generation of ta-C coating machines with much higher productivity and lower cost of microdrill coatings

Excellent hole quality and low cost per hole

## Characteristics of ULF

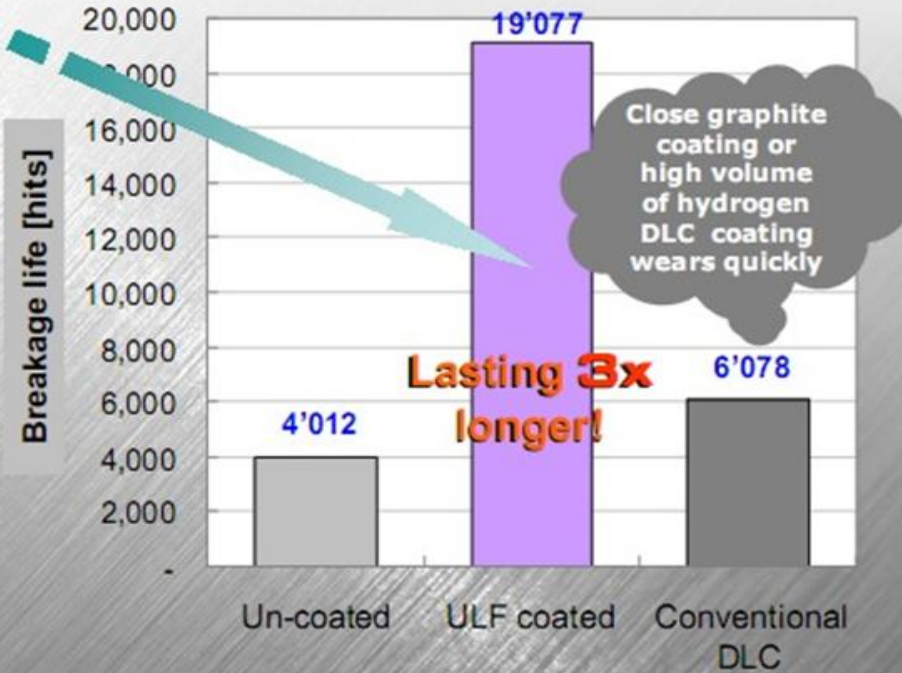
### ULF position



ULF is very similar to diamond DLC  
(high durability coating)

### Ø 0.1 mm tool breakage comparison

(same drill specifications and same drilling conditions)



ULF coated micro drills  
significantly improve the breakage  
resistance

# The Basic technologies of the machine SNC600M



Filtered laser arc deposition, using carbon evaporation from a rotating graphite drum (HOPG), optimizes the hardness, adhesion, and sp<sup>3</sup>/sp<sup>2</sup> ratio of the ta-C coating.

Two carbon sources with variable laser ignition frequencies: 60–100 Hz

Original carbon ion transport system ensuring a high deposition rate and extremely low droplet production.

Synchronization of laser pulses, arc discharge current, pulsed polarization, and dual-anode system.

Power supply for pulsed arc current: 3,000–7,000 A/pulse.

Low-energy, low-temperature ion etching, as well as sharpening of micro-drill cutting edges.

Self-cleaning vacuum window for laser beam passage under vacuum.

# High productivity and low cost coatings



Deposition rate: 0.6micron/hour over 600mm height on 2.5 rotation carousel

- Batch capacity: 12'000pcs of 3.175 mm shank diameter
- Cycle time: 130 min for 300nm thickness
- Process pressure 1.0xE-5 mbar
- Process Temperature : <70C
- Low cost maintenance and running costs



# SNC ta-C coating provides excellent hole quality

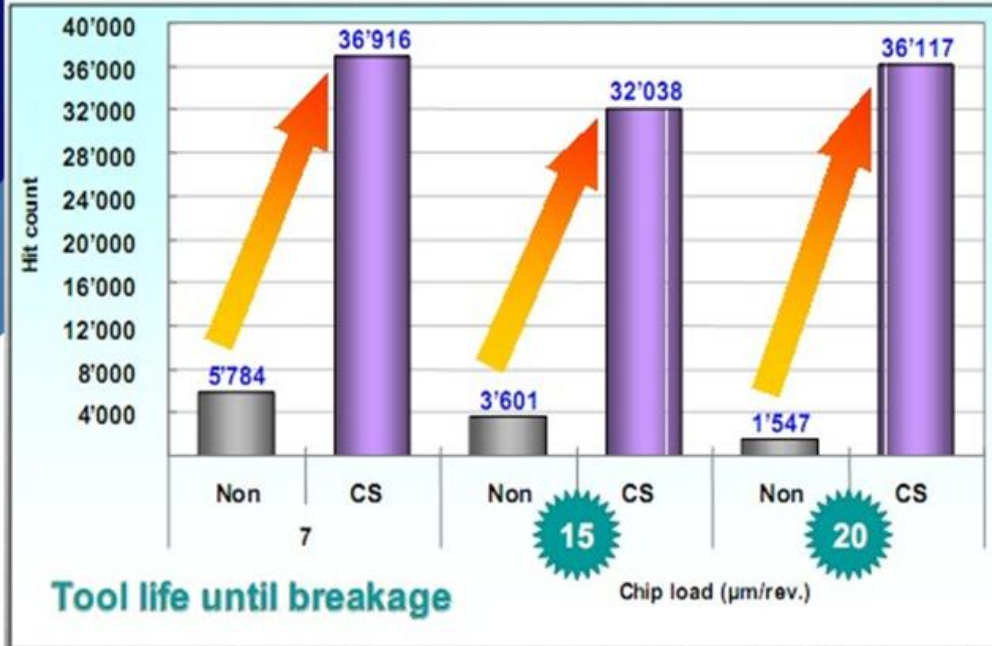
- Ultra Low Friction
- Hardness of coatings :  $> 60$  GPa
- Surface roughness:  $Ra < 10$ nm
- Adhesion : Scratch test on WC  $> 18$ N
- $sp^3/sp^2 > 80\%$
- Raman ID/IG  $< 0.26$  (measured on drill bits)

# Drilling tests results (diameter 0.105-0.150) :



- Ultra Low Coefficient of friction of coted drills
- Excellent chip evacuation
- Excellent Hole quality, registration (Cpk) and position accuracy
- Drill service live time increase by factor x8 vs non coated drill
- Higher chip load drilling is possible with higher productivity and low cost per hole

# Applications...



## DRILLING CONDITIONS

PCB: BT HL832HS t. 0.1 mm (Cu:12/12 µm) 4 panels/stack, E/B: LE800, B/B: Paper phenol t. 1.5 mm

Spindle speed: 300 krpm, Hole pitch: 0.25 mm

Drilling machine: Hitachi 1V-212

(Drilling depth into B/B: 0.2 mm)

SNC® ULF coated drills endure strong drilling stress and a reduced cutting torque

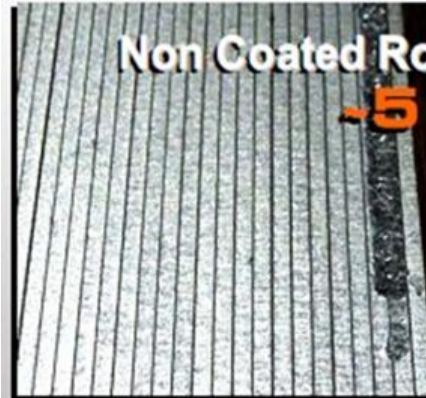
- ➔ *Allowing a higher chip load drilling*
- ➔ *For a higher productivity*
- ➔ *An increased hit count for a lower cost per hole!*

Cost of non coated drill bit Ø 0.105 x 1.5 mm: ➔ 100  
Hit count achieved: ➔ 1'547 hits  
Cost per hole: ➔ 0.065

Cost of coated drill bit Ø 0.105 x 1.5 mm: ➔ 150  
Hit count achieved: ➔ 36'117 hits  
Cost per hole: ➔ 0.004

Cost saving: ➔ **94%**

UNRESTRICTED



**Non Coated Router / End Mill**  
~5 m



**Coated Router / End Mill**  
~200 m!



SNC® ULF coated routers / end mills endure strong milling stress and a reduced cutting resistance

➔ **Allowing a much longer routing / milling distance**

➔ **For a higher productivity**

➔ **For a lower cost per routed / milled distance!**

Cost of non coated router / end mill  $\varnothing$  2.0 x 8 mm: ➔ 1  
Routing distance achieved: ➔ ~5 meters  
Cost per meter: ➔ 20

Cost of non coated router / end mill  $\varnothing$  2.0 x 8 mm: ➔ 1  
Routing distance achieved: ➔ ~200 meters  
Cost per meter: ➔ 0.5

**Cost saving: ➔ 97%**

**ROUTING / MILLING CONDITIONS**

Tested boards: aluminium 1,5 mm, prepreg 80  $\mu$ m copper on top 35  $\mu$ m - E/B: 1 mm Bakelite / phenol brown - B/B: 2,5 mm white coated melamine non pre-routed - routing depth into B/B: 0.8-0.9 mm

S: 35'000 rpm – F: 0.34 m/min – V: 220 m/min

Routing machine: Posalux Ultraspeed