



ISO 9001:2008

TUV Rheinland

DYNA-BLUE, THE ULTIMATE PROTECTION AGAINST WEAR ON CUTTING TOOLS

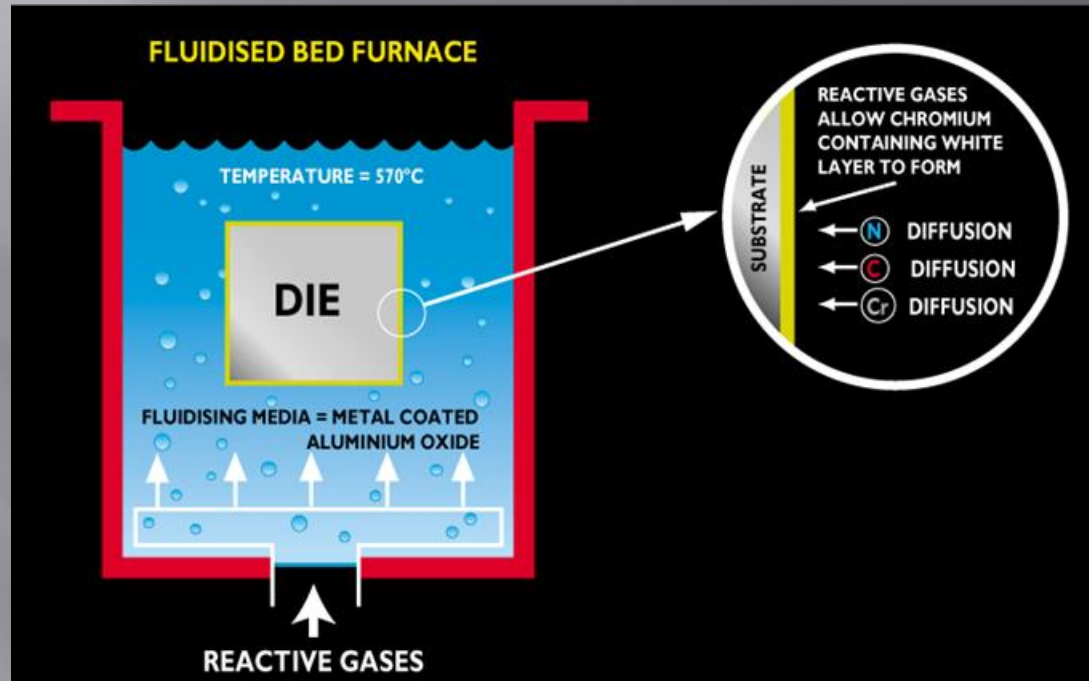
Increasing Tool Life is the Ultimate Goal, to achieving that goal is dependent upon controlling the metallurgical properties of the Cutting Tools to prevent wear, softening, fatigue. This presentation will explore:

- Benefits of DYNA-BLUE® Ferritic Nitrocarburizing Process to increase wear resistance, fatigue and softening, while increasing cutting speeds and release properties.

Fluidized Bed DYNA-BLUE

Fluidization : is the term applied when making aluminum oxide or sand particles react like a liquid in a heat treating furnace. Process gases are introduced to the furnace through a diffusion plate, located in the bottom of the furnace. The gases are pressurized thus lifting and moving the sand scrubbing the part with fresh reactive gases and provides uniform heating + 2°F, thereby ensuring consistent metallurgical properties with 6 times the thermal transfer of atmosphere. The process is not inhibited by part geometry or blind holes and maintains finish.

Fluidized Bed Schematic



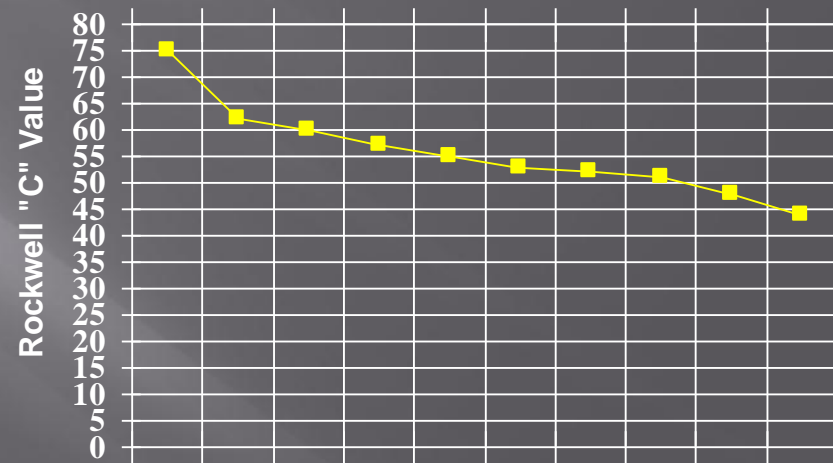
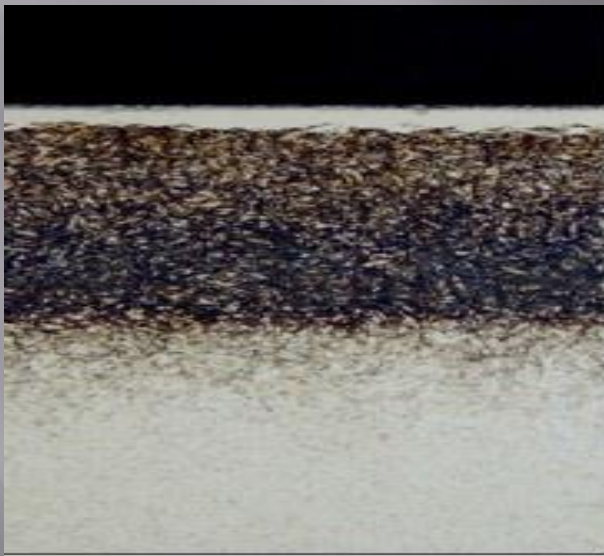
The fluidized bed furnace is capable of maintaining temperatures of $\pm 2^\circ \text{F}$. Inert, atmospheres are introduced through the bottom of the furnace while the furnace shell/retort is electrically heated. As the retort heats, the inert gas scrubs the heat off the walls transferring heat directly to the dies, much like that of boiling water. When the furnace reaches the desired set point, the DYNA-BLUE[®] reactive gases can be introduced, providing excellent case depth uniformity.

What is DYNA-BLUE® Ferritic Nitrocarburizing?

DYNA-BLUE is a low temperature, (typically 950° – 1050° F), thermal-chemical diffusion process applied via a Fluidized Bed Furnace, that yields two metallurgical characteristics:

- 1) Epsilon Iron Carbonitride Compound layer that is composed of Nitrogen & Carbon and has a hardness of up to 75HRC. The layer can be produced from .0001" – .002" depending upon the application and properties needed.
- 2) A nitrogen enriched diffusion zone 60+ HRC that supports the compound zone. This layer can be produced from .0005" to greater than .015".

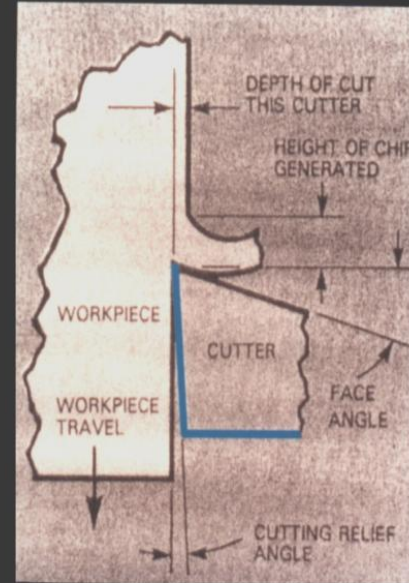
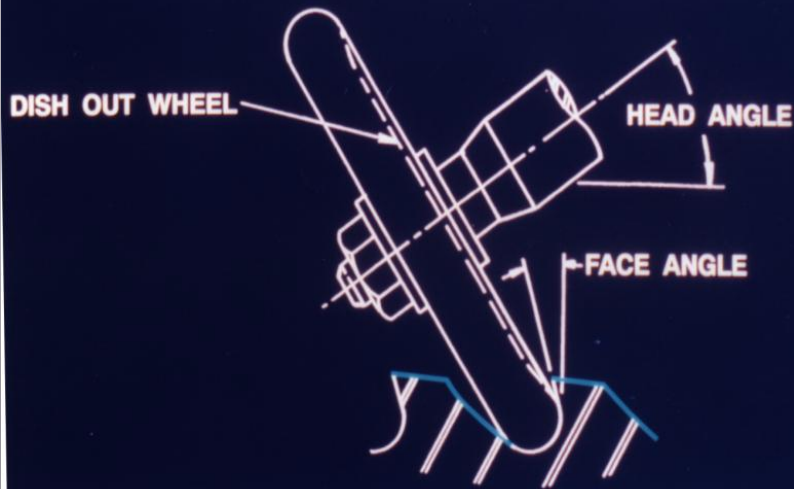
Microstructure and Microhardness Graph



The picture on the left shows .0002" compound (white) layer supported by a nitrogen rich (dark) diffusion zone. The graph on the right exhibits a typical microhardness traverse on H-13 with DYNA-BLUE 6B cycle. The first value is 75HRC at .0002" with each descending value equal to .001".

Face Sharpening after DYNA-BLUE

INTERNAL BROACH SHARPENING DYNA BLUE D BROACHES



DOES NOT REQUIRE RE-DYNA-BLUE® AFTER FACE SHARPENING
AS DYNA-BLUE® IS STILL ON THE LEADING EDGE. PVD
COATINGS USUALLY REQUIRE RE-COATING AFTER EACH
SHARPENING WHICH INCREASES TOOL COST.

Benefits of DYNA-BLUE® vs TiN or TiAlN Coatings on Cutting Tools

- 75+ HRC Surface = Increased wear resistance - maintain sharp cutting edges.
- Increased depth of hardness: DYNA-BLUE® is .0005"-.002" deep vs TiN Coating is .0001"-.0002" thick. DYNA-BLUE® is up to 10 times thicker which leads to better galling resistance. Pressure or load on the surface can break thru the thin layer of TiN and start delamination and wear.
- DYNA-BLUE® has uniform growth of <.00005" with no buildup on cutting edges or root diameters. TiN coating can cause broach to cut oversize due to buildup on edges and coating overtop of an edge can dull it.
- DYNA-BLUE® has a metallurgical bond as it is diffused into the steel vs TiN coating which does not. Tin coating can peel
- Does not require re-DYNA-BLUE® after face sharpening as DYNA-BLUE® is still on leading edge. PVD coatings require
- re-coating after each sharpening which increase tool cost.
- DYNA-BLUE® is much lower cost than TiN or TiAlN and much more cost effective
- Overnight turnaround