

Ultimate Surface Performance for Automotive Components

HEF Group is the exclusive supplier of both Liquid Nitriding treatments and PVD/DLC coatings to the automotive industry.

Through its jobbing facilities and licensees, HEF Group is the world's largest supplier of wear, friction and corrosion reduction treatments and coatings to the automotive industry. Two-thirds of all passenger cars worldwide use HEF's technologies in powertrain, drivetrain, braking systems and elsewhere.

Liquid Nitriding (LN) / Salt Bath Nitriding (SBN) / Nitrocarburizing

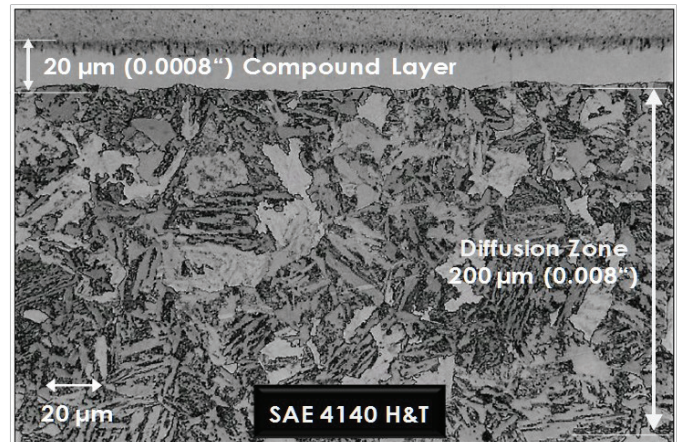
Liquid Nitriding is a thermo-chemical **diffusion** treatment that enriches the surface of steels and cast iron with Nitrogen.

The surface **Compound Layer** is composed of iron nitrides + special nitrides. The area below the compound layer is the **Diffusion zone**, where Nitrogen diffuses into the iron lattice to form a solid solution.

HEF Group's trademarked family of Liquid Nitriding processes:

ARCOR[®] : ARCOR V, ARCOR C,
ARCOR N, ARCOR DT, SURSULF[®]

MELONITE[®] : TF1, QP, QPQ,
TENIFER[®] TUFFTRIDE



Liquid Nitriding Benefits

- Hard (600-1200 HV) surface layer provides very good wear resistance
- Good frictional properties
- Excellent scuffing / seizure protection (adhesive wear)
- Excellent corrosion protection
- Good surface fatigue resistance
- Decorative black surface

Liquid Nitriding Automotive Applications

Brake System Components



Rotors

- Significant corrosion reduction for increased rotor life
- No compromise of braking characteristics
- Prevents brake pedal or steering wheel shudder caused by an uneven buildup of rust on the rotor. Nitrided rotors create less brake dust than untreated rotors



Brake Pistons

- Significantly higher corrosion resistance than chrome plated pistons
- Excellent friction properties



Brake Pad Backing Plates

- Much higher corrosion resistance and durability than conventional treatments
- Good brake pad adhesion

Valve Train Components



Engine Valves

- Excellent fatigue, impact and stem anti-scuffing properties
- Superior corrosion resistance
- Lower coefficient of friction
- Cost effective
- Delivers superior performance compared to chrome plated and plasma nitrided valves



Rocker Arm Shaft & Rocker Arms

- Minimize adhesive wear
- Reduced friction
- Possibility to use rocker arm without bushing



Drivetrain / Differential Components



Clutch Plates: Enhanced wear & fatigue resistance; superior clutch durability

Differential Pins: Higher wear resistance; lower cost than nickel-plating; lower friction

Differential Casing: Cast Iron component -improved wear resistance

Torque Converter: Improved adhesion of friction material; improved wear and corrosion protection

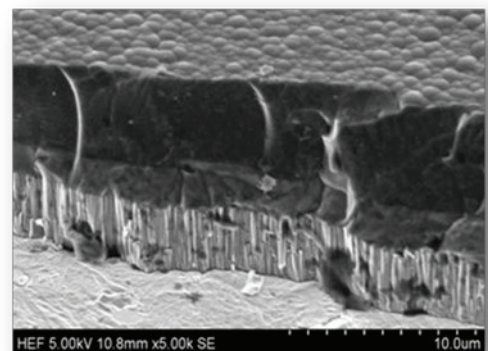
PVD / Diamond-Like-Carbon (DLC) Coatings

While Liquid Nitriding is a surface modification technology, Physical Vapor Deposition (PVD) involves the deposition of very hard, thin (2-4 microns; 0.0001"- 0.0002") films on the surface of components.

The PVD process, conducted under high vacuum conditions, involves the extraction of material, in atomic or ionic form, from a high-purity solid source, such as Titanium or Chromium. This extraction is done by bombarding the source material with high-energy inert gas ions. The extracted ions/atoms react with gases such as Nitrogen to form thin and very hard coatings such as Titanium and Chromium nitride. If a source material, such as a hydrocarbon gas is used, a very hard, ultra low-friction Diamond-Like-Carbon (DLC) coating can be deposited.

PVD / DLC Coating Benefits

- Very hard (1500-4500 HV): high resistance to wear, abrasion and erosion.
- Thin (2 to 5 microns) coatings
- Low friction coefficients (0.1-0.5)
- Low coating temperatures (150-250° C)



DLC Coating Automotive Applications

Power Cell Components



Piston Pin

Piston Ring

- Significant friction reduction
- Piston pin: higher load sustainability without seizure

Valve Train Components



Rocker Arm Pin



Valve Tappet



Rocker Arms

- Improved wear resistance

- Convert sliding contact to rolling contact: significant friction reduction

Fuel System Components



Plungers

- Improved sliding wear resistance
- Significant friction reduction



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