



**BÖHLER** UDDEHOLM

Duplex-TIGRAL<sup>®</sup> Coating



## The Duplex-TIGRAL® Benefit

BÖHLER-UDDEHOLM developed this high performance Physical Vapour Deposition coating for very high resistance against oxidation and abrasion. This two stage process is comprised of a specially developed Plasma Nitride followed by a mono layered matrix coating. Duplex-TIGRAL was created to eliminate the drawbacks associated with high temperature coatings like Thermoreactive Diffusion and Chemical Vapour Deposition. Duplex-TIGRAL will easily match the performance levels of these hot treatments and can be stripped and recoated multiple times.

### Benefits of Duplex-TIGRAL:

- ▶ Increased Tool Life
- ▶ Lower Tool Maintenance
- ▶ Reduced Down Time
- ▶ Higher Productivity
- ▶ Improved Part Quality



## Features

The low application temperature of Duplex-TIGRAL ensures the metallurgical characteristics of your BÖHLER-UDDEHOLM steel are maintained. Tooling dimensions will remain unchanged to expedite tool assembly at reduced costs. The mono-layered matrix composition of Duplex-TIGRAL creates a very ductile film ideal for abrasive environments such as die casting and hot forging. The high oxidation temperature provides coating stability and long life in higher temperature applications.

The unique chemistry of Duplex-TIGRAL offers protection from materials that corrosively attack the tool steel. This results in reduced adhesive wear and alloying between work material and tool steel which results in enhanced part release and greater productivity.

- ▶ High Hardness and Wear Resistance
- ▶ Superior Abrasion and Erosion Resistance
- ▶ Corrosion Resistance from Alloying Attack
- ▶ High Oxidation Temperature and Thermal Stability
- ▶ Improved Coefficient of Friction

# Duplex-TIGRAL® Coating

## Applications

Duplex-TIGRAL clearly provides performance improvements to tools in the most severe applications. Increased tooling life and reduced maintenance costs have been demonstrated in the following applications:

- ▶ High Pressure Aluminum Die Casting
- ▶ Forming of Abrasive Stainless Steel and Ferrous Alloys
- ▶ Hot and Cold Forging
- ▶ Hot Stamping
- ▶ Non Ferrous Extrusion

Duplex-TIGRAL offers excellent adhesion and performance on all common and advanced tool steels including properly welded substrates. It can be applied to:

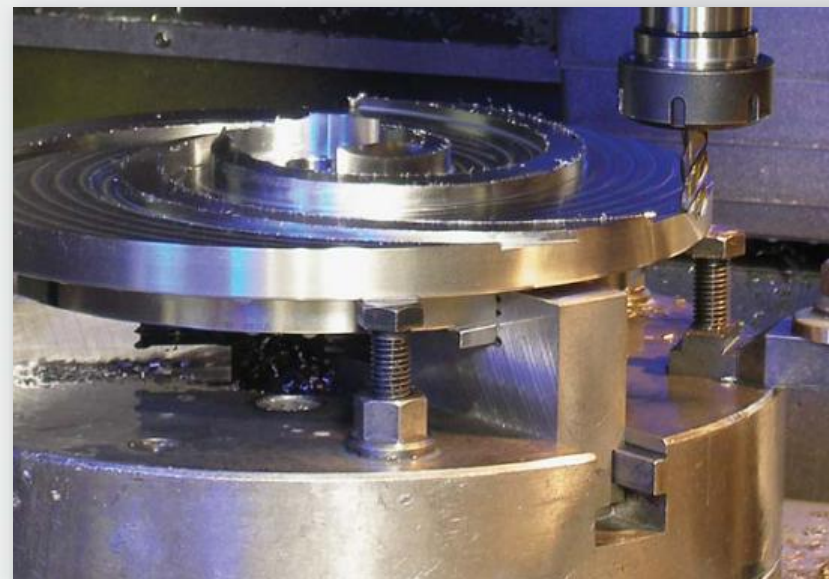
- ▶ UDDEHOLM Orvar® Supreme and Orvar® Superior
- ▶ BÖHLER W403 VMR®
- ▶ BÖHLER W400 VMR®
- ▶ UDDEHOLM Dievar®
- ▶ BÖHLER W360 ISOBLOC®
- ▶ H13, H11 and other hot work tool steel
- ▶ UDDEHOLM Caldie®
- ▶ BÖHLER K340 ECOSTAR®/ISODUR® (8 percent Chromium tool steel)
- ▶ High Temperature Tempered D2 and other cold work tool steels

## TIGRAL: Additional Applications

TIGRAL can also be applied using a non-duplex process. Applications include coated cutting tools for dry machining, and tools that machine at high feed rates. Ideal for tools that specialize in interrupted cuts. TIGRAL can also be used in the reaming of medium and highly alloyed steels. Additionally, it can be used in warm and cold forming, and hot stamping processes where high ductility and low tendency to cold weld to the steel are required.

## Properties

- 
- ▶ Material: Aluminum Chromium Titanium Nitride
  - ▶ Micro-hardness HV 0.05: 3300 ± 300
  - ▶ Coefficient of friction: 0.6
  - ▶ Layer thickness: 3-5 µm
  - ▶ Maximum service temperature: 900°C/1650°F
  - ▶ Colour: Dark Grey
  - ▶ Plasma nitriding: .002" case depth, zero white layer
  - ▶ Process temperature: 500°C/925°F) maximum (with Duplex process)
- 



## The Duplex Advantage

Our proprietary Duplex system provides increased PVD performance using in-situ Plasma Nitriding prior to coating. The resulting surface preparation provides improved coating adhesion and support while improving wear resistance. The Duplex Advantage provides process and cost improvements you can rely on! Call us to arrange a visit from one of our Technical Sales Representatives.

## Full Service Coating Services

BÖHLER-UDDEHOLM can service all coating requirements from new tooling programs to the refurbishment and recoating of existing tools. Our capabilities include:

- ▶ Heat Treating
- ▶ Mechanical and Chemical Coating Removal
- ▶ Welding
- ▶ Polishing
- ▶ Micro-Blasting
- ▶ PVD Coating of Small to Large Tooling
- ▶ Pick-up and delivery

## Technical Support

With over 60 years of service to the tooling industry we understand your concerns and know how to address them. We are committed to providing technical support to ensure your applications achieve their targets. We draw our expertise from years of servicing multiple market segments across the globe.



# BÖHLER UDDEHOLM

### **BÖHLER-UDDEHOLM LTD.**

2645 Meadowvale Blvd.  
Mississauga, ON L5N 7Y4  
P + 1 905-812-1701  
F + 1 905-812-9231  
info@bucanada.ca  
www.bucanada.ca

### **Eifeler Coatings Technology**

3800 Commerce Drive  
St. Charles, IL 60174  
P + 1 630-587-1220  
F + 1 630-587-1230  
sales@eifeler.us  
www.eifeler.us

### **Eifeler Coatings Technology**

2222 Spikes Lane  
Lansing, MI 48906  
P + 1 517-708-8034  
F + 1 517-913-6279  
sales@eifeler.us  
www.eifeler.us

### **ASSAB Tooling technology Shanghai**

No 4088 Humin Road Shanghai  
China 201108  
P + 86 21 24169688  
D + 86 21 24169666  
F + 86 21 24169667  
david-liang@assabsha.com  
www.assab.china.com

REV\_1 01/2016