

# BONDERITE® THIN FILM PROCESS



# ▶ TABLE OF CONTENTS

1 About Henkel & Our Metal Pretreatment Capabilities

---

2 Market Dynamics

---

3 Key Details & Advantages of BONDERITE Thin Film

---

4 Converting a Line to BONDERITE Thin Film

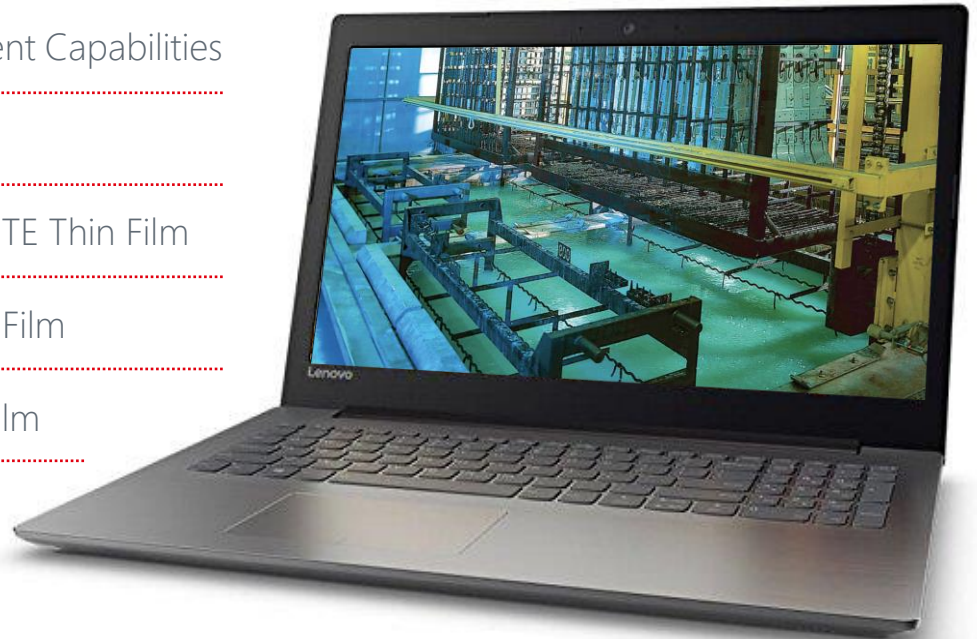
---

5 Future Direction of BONDERITE Thin Film

---

6 Summary

---



A large red arrow pointing to the right, containing the number 1.

1

# ABOUT HENKEL & OUR METAL PRETREATMENT CAPABILITIES

# ▶ WHO WE ARE

## Henkel At A Glance

SALES  
**€20.1 Bn**



More than  
**143** Years success  
with brands and  
technologies



We are active in  
**78**  
countries

Three business units

Adhesive Technologies  
Beauty Care  
Laundry & Home Care

**€3.2** Bn  
adjusted  
operating profit (EBIT)



Leading in sustainability  
**+56%**  
resource efficiency



Around  
**2,000**  
social projects  
supported



We employ **MORE THAN**  
**52,000**  
PEOPLE worldwide from  
120 nationalities



Around  
**36%**  
WOMEN IN  
MANAGEMENT

# ▶ HENKEL METAL PRETREATMENT BONDERITE Thin Film Presence

**Robust support**  
~65 testing chambers  
  
>300 analytical  
methods

Customers include major automotive manufacturers from around the world.



▶ More than 4M vehicles pretreated annually with Henkel's BONDERITE Thin Film process.

# ▶ GLOBAL RESEARCH & DEVELOPMENT CENTERS

## North America

### Madison Heights, MI

Proximity to OEM headquarters and technology centers



## Europe

### Düsseldorf, Germany

Embedded in Henkel's most modern R&D center for Adhesive Technologies



## APAC

### Shanghai, China

Strong local presence in growing market



▶ Global product development aligned toward market trends

# ► COMPREHENSIVE PROCESSING & TESTING

## Corrosion Testing



In-house testing of corrosion performance

.....  
~65 test chambers,  
~60.000 samples per year

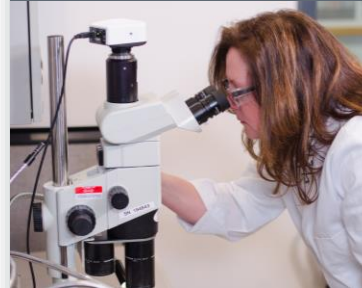
## Instrument Analysis



Expert team with > 130 analytical methods

.....  
Routine analysis,  
troubleshooting

## Surface Analysis



Broad range of modern surface analytical and spectroscopic methods

.....  
Microscopy/  
chemistry

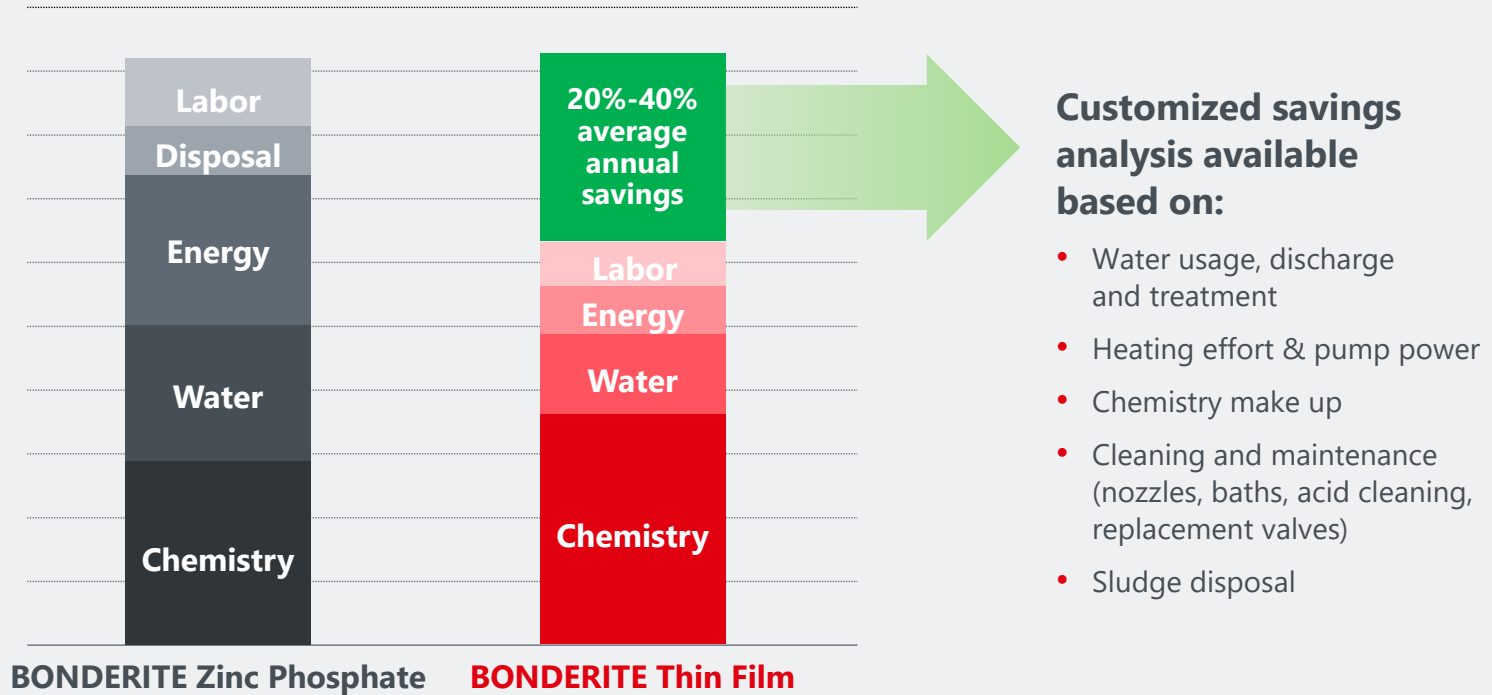
## Process Development



Lab scale to fully automated pilot line

.....  
Panel programs, samples,  
on-site consulting

# ▶ COST SAVINGS ANALYSIS





2

# MARKET DYNAMICS

# ► TRENDS ADVANCING THIN FILM ADOPTION



## Cost Reduction in MPT

### COSTS



- Reduced consumption of materials, energy & water
- Less waste disposal
- Reduced greenfield investment through lean and robust processes



## Sustainability



- Lead beyond compliance with legal regulations
- B, Ni, NO<sub>x</sub> (PO<sub>4</sub>) avoidance
- Reduced energy demand

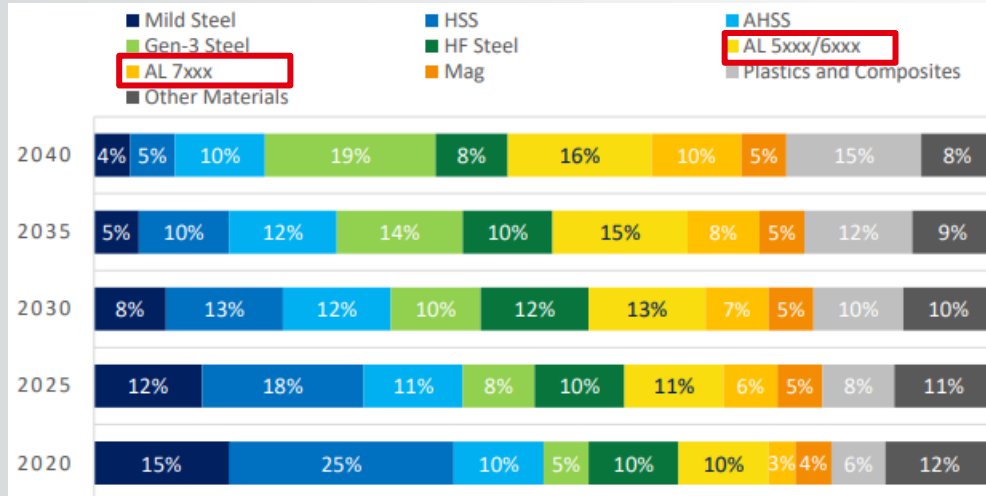


## Lightweight Construction



- Tightening CO<sub>2</sub> emission standards
- Increase of lightweight materials: aluminum, magnesium, high strength steel, CFRP

# ▶ ROLE OF ALUMINUM



## Increased aluminum use further optimizes ICE vehicles, while driving growth of the EV market

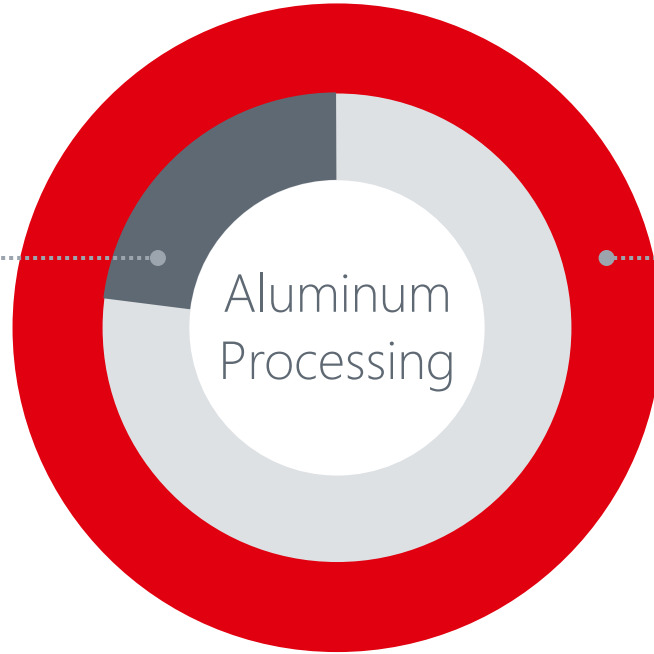
- Enhance crashworthiness
- Reduce weight up to 50% compared to steel
- Maintain optimal EV operating conditions (temperature)
- Support increased recyclability
- Corrosion resistance

# ▶ BONDERITE® THIN FILM ENABLES INCREASED ALUMINUM

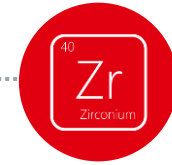
Zinc Phosphate



**UP TO 30%**



BONDERITE Thin Film

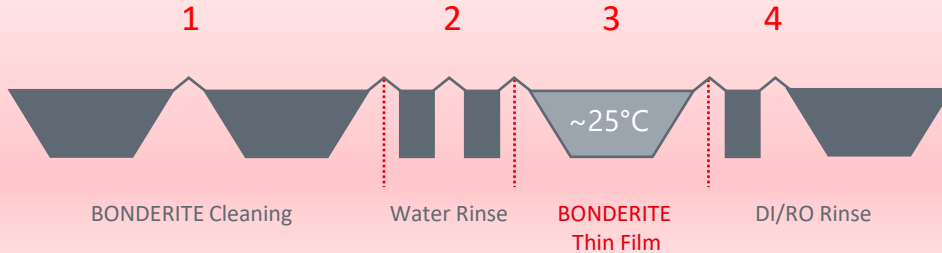


**UP TO 100%**

# ▶ BONDERITE THIN FILM ADDRESSES MARKET NEEDS

## BONDERITE Thin Film Process

*\*Greenfield site*



### Process Benefits

- High performance across major substrates
- Processing of all major metals, **including up to 100% aluminum**
- No heavy metal phosphates
- Ambient temperature
- Significant sludge reduction
- Water savings



3

## KEY DETAILS & ADVANTAGES OF BONDERITE THIN FILM

# ▶ BONDERITE THIN FILM PROCESS STEPS



## **Value**

Clean surface, full wettability

## **Number of Stages**

2-3 stages

## **Application Type**

Dip or spray

## **Additional Details**

70% of coating failures associated with poor cleaning

## **Value**

Prevent contaminant carry over

## **Number of Stages**

2 stages

## **Application Type**

Dip or spray

## **Additional Details**

Water cleanliness most important factor

## **Value**

Conversion coating deposition for corrosion protection & paint adhesion

## **Number of Stages**

1 stage

## **Application Type**

Dip or spray

## **Additional Details**

No limit for aluminum

## **Value**

Ensure no contaminants under paint film

## **Number of Stages**

2 stages

## **Application Type**

Dip or spray

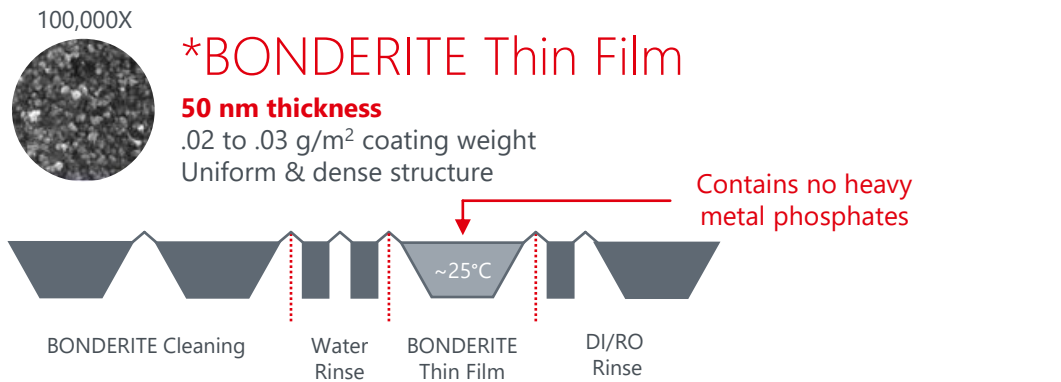
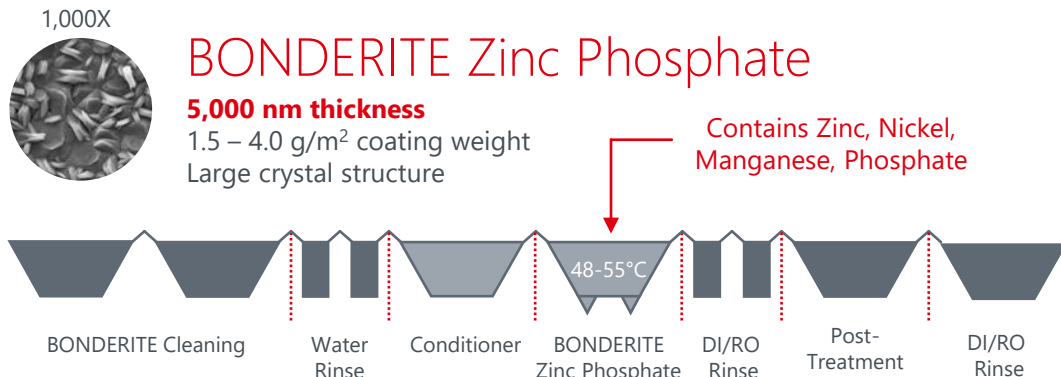
## **Additional Details**

Water, tap or DI/RO

## **Paint Types**

CED-coat (OEM, AS)  
Spray Paint (AS)  
Powder Paint (AS)

# ▶ IMPROVED PROCESS OVER ZINC PHOSPHATE

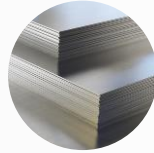


Metal Application	Conditioning	Temp.	Sludge
All major metals  <b>Aluminum limited up to 30%</b>	Required	Heated	Significant
All major metals  <b>No limitations</b>	Not needed	Ambient	Virtual elimination



# ▶ EFFECTIVE ACROSS ALL MAJOR METALS

Aluminum



**REDUCED CREEP DEMONSTRATES IMPROVED CORROSION PREVENTION**

**BONDERITE**  
Zinc Phosphate Creep

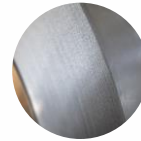


**BONDERITE**  
Thin Film Creep



Hot Dipped Galvanized

Electrogalvanized



**EQUIVALENT OR REDUCED CREEP DEMONSTRATES EFFECTIVE CORROSION PREVENTION**

**BONDERITE**  
Zinc Phosphate Creep



**BONDERITE**  
Thin Film Creep



**BONDERITE**  
Zinc Phosphate Creep



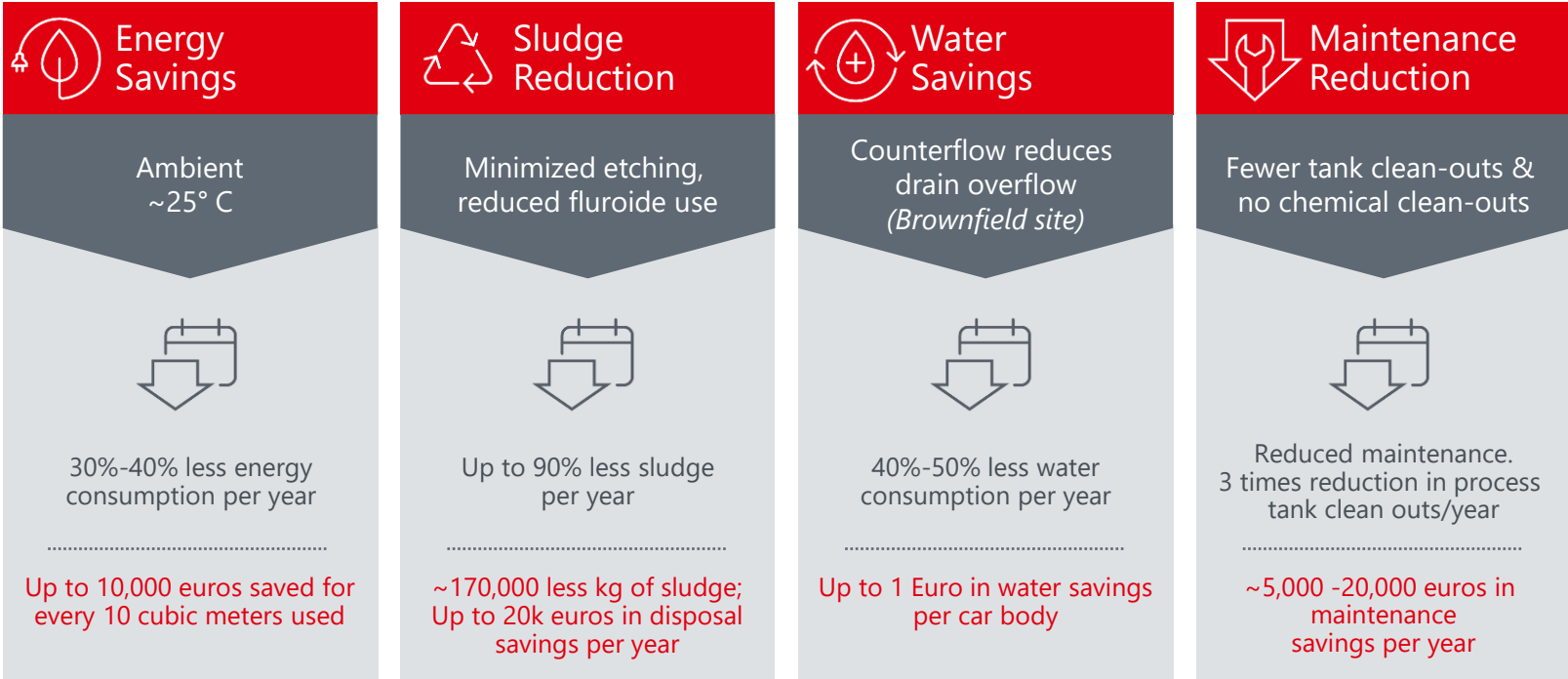
**BONDERITE**  
Thin Film Creep



Equivalent or improved performance demonstrated during localized cyclic testing.

*\*Performance results may vary*

# ▶ KEY RESULTS



4


# MAINTAINING BATH STABILITY


# ▶ MAINTAINING BATH STABILITY

Ongoing monitoring of key variables essential to maintaining bath stability.  
Henkel offers on-site & off-site support.



## KEY VARIABLES

 Free alkalinity

 Temperature


 pH


 Surfactant

 pH

 Conductivity

 pH

 Temperature

 Absorbance

 Fluoride

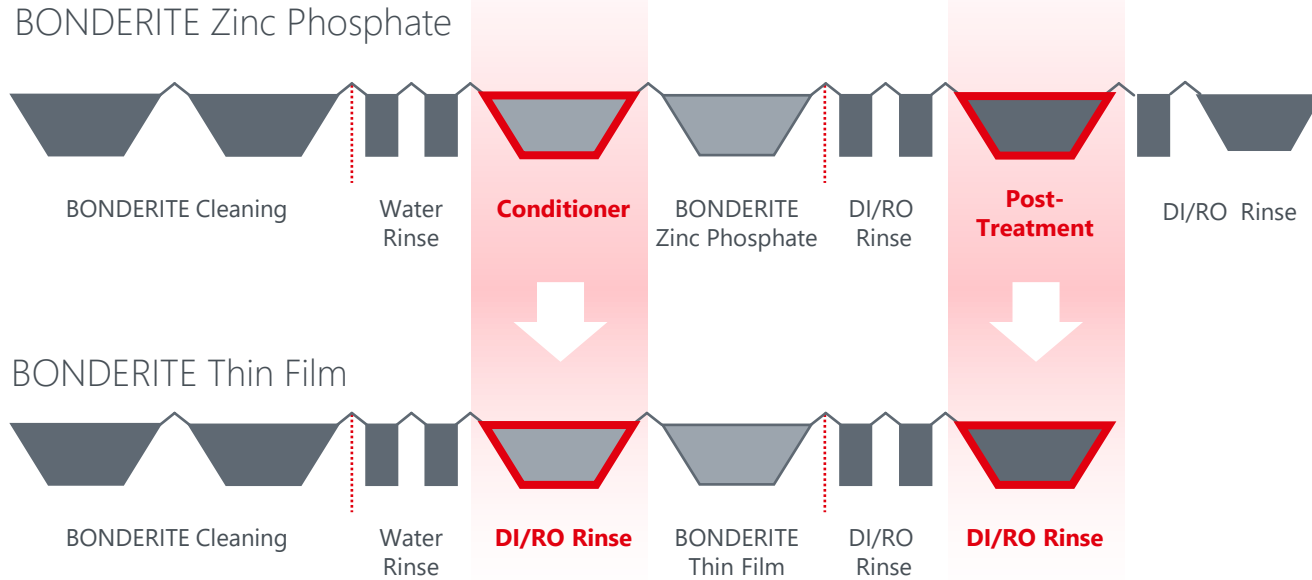
 pH

 Conductivity

5

## CONVERTING A LINE TO BONDERITE THIN FILM

# ▶ LINE CONVERSION TO BONDERITE THIN FILM



Line infrastructure can remain the same.

Conditioner and post-treatment steps become additional rinses.

# ▶ CONVERSION SUCCESS STORY

## MAJOR AUTOMAKER IN CHINA

### Challenges

- Needed to meet tightening environmental restrictions related to heavy metal phosphates.
- Process and durability performance required to be equivalent to the zinc phosphate process.
- Process costs needed to be reduced while simultaneously decreasing ecological footprint.

### Solutions

- Henkel recommended the Brownfield Conversion of a zinc phosphate line to a BONDERITE Thin Film line.
- **Key facility updates included:** Conversion of surface conditioning tank to DI rinsing; elimination of heat exchanger & laminar flow in conversion coating; replacement of filter press with bag filters
- **Key material changes included:** replacement of alkaline degreasing chemicals with BONDERITE cleaner; chemical cleaning of surface conditioning and conversion tanks; charging of zirconium thin film chemicals to previous zinc phosphating stage; elimination of passivation materials.



### Benefits

- Annual cost savings of ~190,000 Euros.
- Throw power performance after thin film conversion equivalent to zinc phosphating system.
- High performance corrosion protection on all major metals & up to 100% aluminum
- Sustainable process with no heavy metal phosphates, no heating in the conversion stage and no surface conditioning.

6

# FUTURE DIRECTION OF BONDERITE THIN FILM



# ▶ BONDERITE THIN FILM FUTURE DIRECTION

## TODAY

### Zr-Oxide for Multi Metal

---

State-of-the-Art  
BONDERITE Thin Film  
Process

- BONDERITE® M-NT 1800, 1820, 1850
- Nickel-free
- Short process
- Less energy, water, waste
- No limit for aluminum in metal mix

## NEAR-TERM

### Zr-Oxide Next-Gen

---

Improved Performance  
and Process Robustness

- Iron deposition for improved performance on individual substrates
- Modular approach to fulfill specific customer needs
- Increased process robustness

## LONG-TERM

### Beyond Zr-Oxide

---

Next Platform for  
Sustainable Metal  
Pretreatment

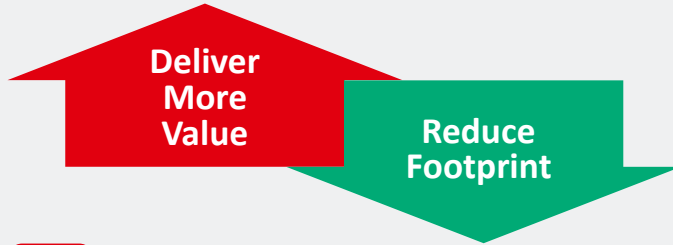
- Leverage synergies between coating technologies
- Reduce to minimal environmental footprint

7

# SUMMARY

# ▶ BONDERITE THIN FILM PROCESS

## Summary of Advantages



Better Health and Safety



Less Energy Consumption **30% – 40%**



Less Sludge **Up to 90%**



Less Water Consumption **40% – 50%**



THANK YOU

