

SME-driven innovation in surface finishing

A long-term success story



Zentralverband
Oberflächentechnik



Lionel Thiery
COVENTYA S.A.S.

Resource efficiency in manufacturing companies & supply chains
Dinner debate – Brussels – 1 February 2011

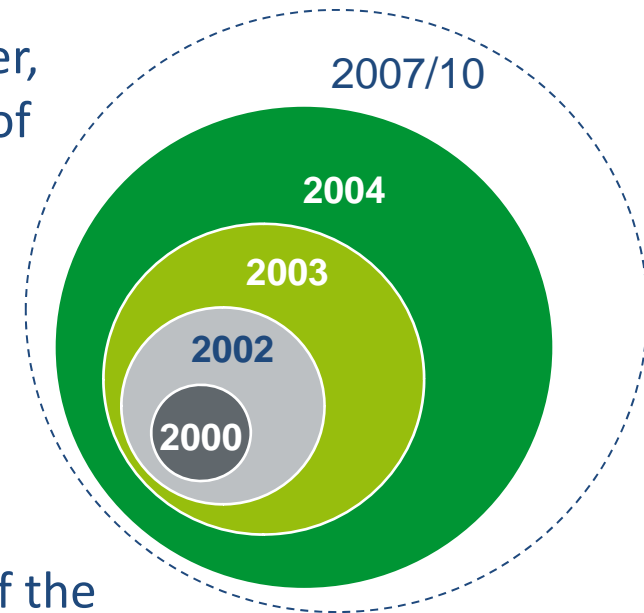
Agenda

- **Coventya group**
- **Surface Finishing : a crossroad of activity**
- **Innovations derived from European regulations**
- **Present and future challenges for surface finishing**
- **Conclusions**

COVENTYA Heritage

and beyond...

- **1927** Creation of Société Continentale Parker, France to run processes and patents of Parker Rustproof Co., USA
- **1965** Acquired by Metallgesellschaft Group, Germany
- **1989-2000** Organic and external growth in Europe
- **2000** Creation of **COVENTYA**: acquisition of the Plating Business Unit by the Management and a Private Equity Company
- **From 2000** Second phase of development and acquisitions in Europe, Americas and Asia.



Group Worldwide Structure

CIGAL
Coventya Headquarters

Coventya S.p.A.
Italy

Coventya S.A.S.
France

Coventya GmbH
Germany Finland

Coventya
Technologies S.L.
Spain

Coventya A.B.
Sweden

Coventya México, S.A. de C.V.
México

Coventya Inc.
USA

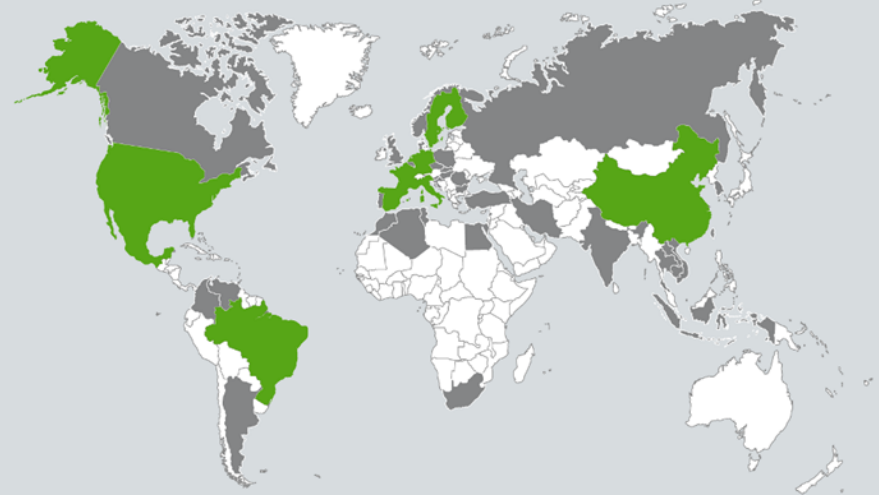
Coventya Quimica Ltda
Brazil

Coventya Surface Treatment
Technology (Suzhou) Co., Ltd
China

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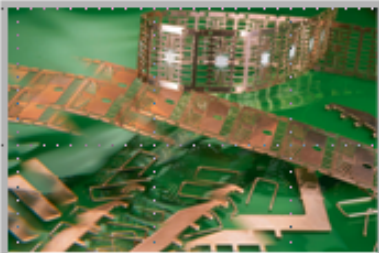


COVENTYA Locations

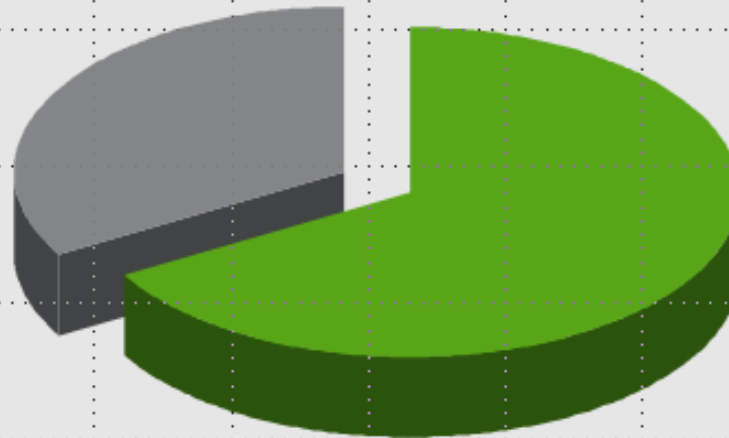
Worldwide Distributors

Activity of COVENTYA: focus on **General Metal Finishing**

- Electroplating Specialists



PCB 0.8 bill.€



World Market : 2 bill.€



GMF 1.2 bill.€

Activity of COVENTYA

PREPARATION



- Cleaning
- Activating

PROTECTION



- Corrosion resistance
- Easy to assemble
- Aesthetics

DECORATION



- Corrosion resistance
- Brightness
- Cosmetics

PRECIOUS METALS



- Corrosion resistance
- Brightness
- Cosmetics

FUNCTIONAL



- Hardness
- Abrasion resistance
- Conductivity

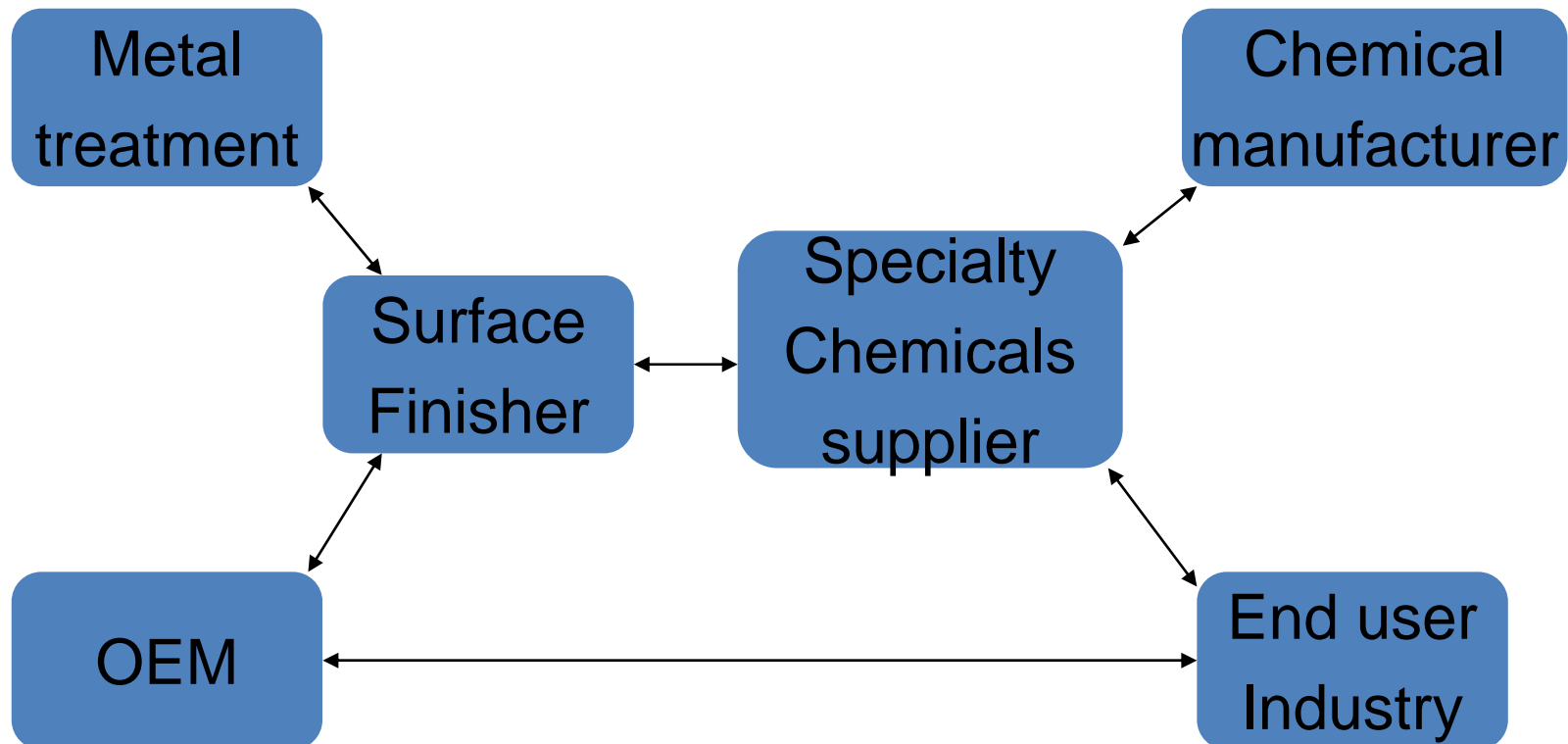
WaterCare



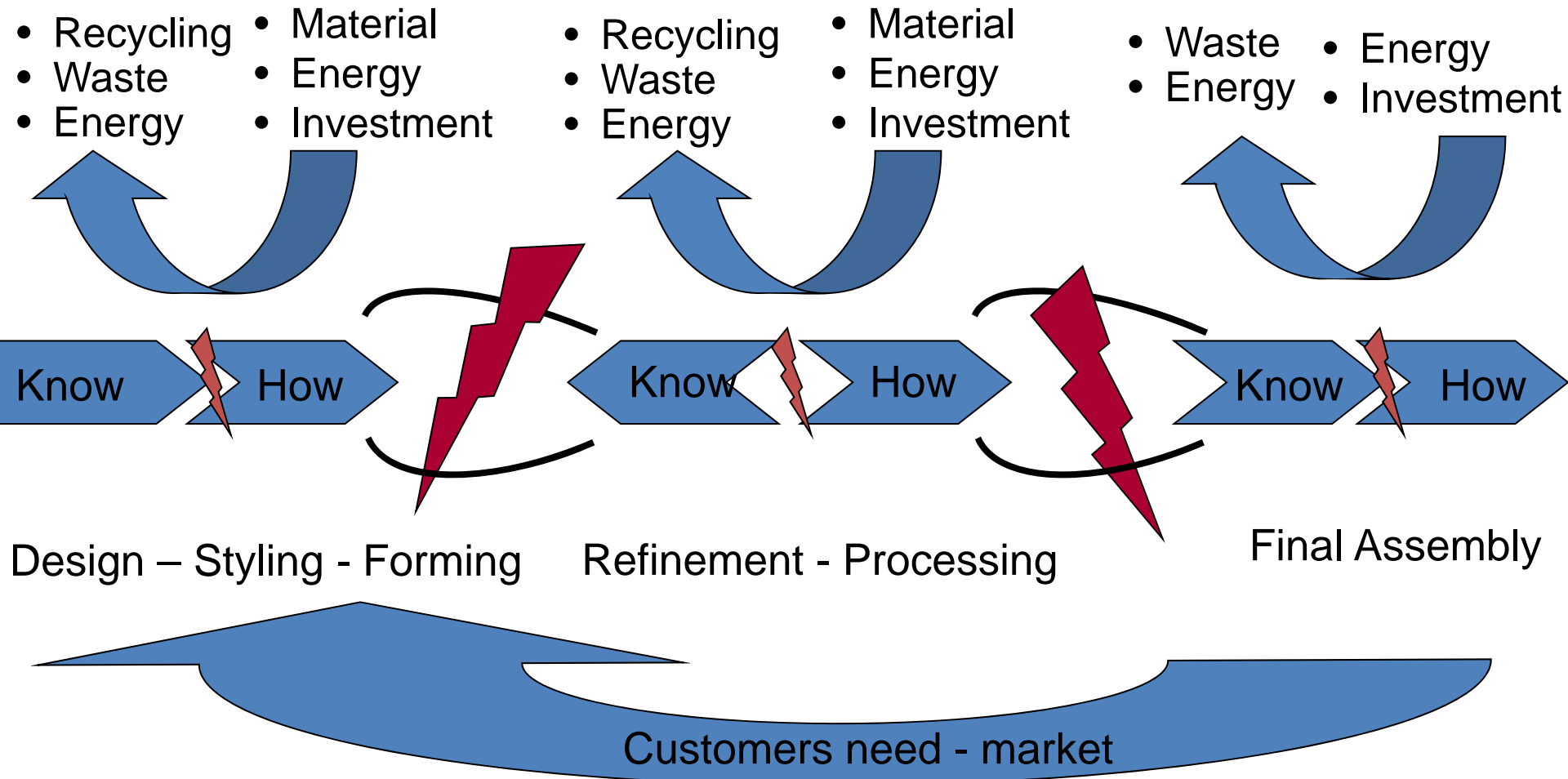
- Coagulation
- Flocculation
- Metal precipitation

Surface Finishing: a crossroad of branches of activity

- Surface Finishing
 - Key component in the supply chain

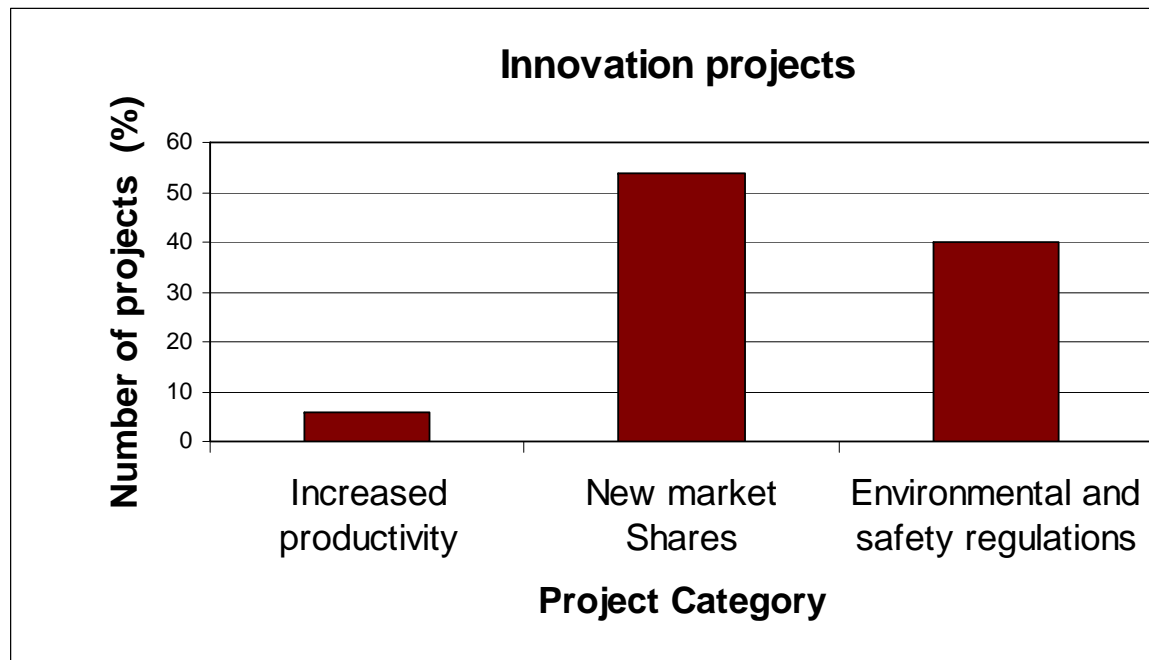


Interconnections within chains of production



What is driving innovation within our group?

- Increase in productivity
- New market shares
- Environmental and safety regulations



How is innovation managed in a group like Coventya?

- **Internal Research and Development:**
 - 6 R& D sites worldwide
 - Protection of inventions by patent applications
 - Licence partnerships
- **Cooperation with universities and institutes:**
 - UFR Besançon (FR), MTM Leuven (BE), TU Dresden (DE), SINTEF (NO), University of BRESCIA (IT), CPERI (GR)...
- **European projects :**
 - EUPOLYMET : Improvement of the adhesive and corrosion resistance properties of unpainted and painted electrogalvanized steel
 - EUSILACOR : Nanometric silica as a new surface treatment for the corrosion protection of steel and galvanized steel
 - NANOCAPS : Nano-capsules for Targeted Controlled Delivery of Chemicals
- **Pole de compétitivité :**
 - Pôle Véhicule du Futur : Innovation in transport industry



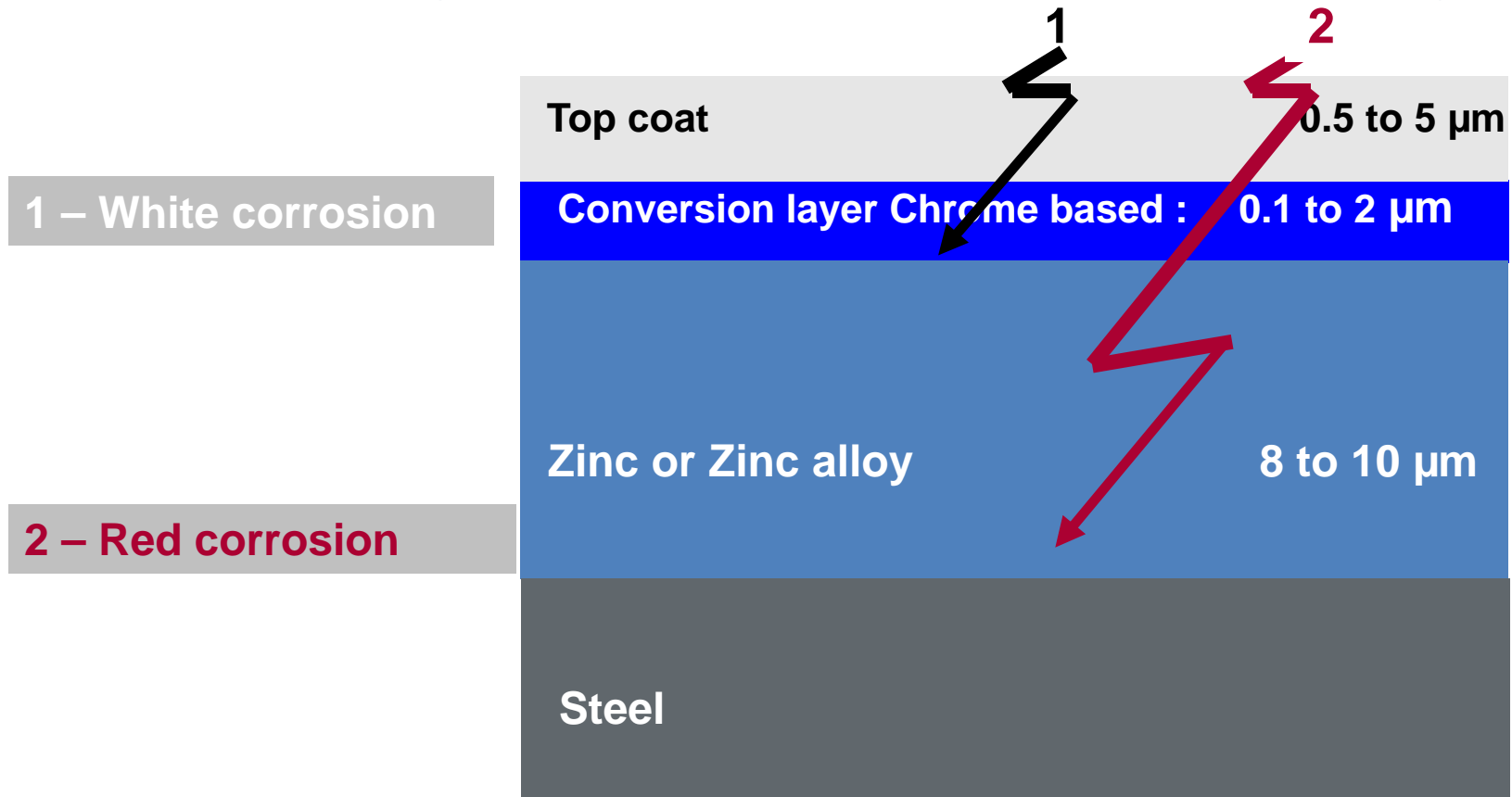
Innovations fulfilling the European regulations

ELV directive 2000/53/CE :

- Recycling of vehicles:
- Entered into force on 1st July 2007
- Maximum allowed concentration: 0.1% w/w per homogeneous material for Pb, Hg, Cr^{VI} and 0.01 % for Cd
- Every year: end of life of vehicles generate between 8 and 9 millions tonnes of waste.
- Preference should be given to reuse and recycling
- Target : ensure that Pb, Cr^{VI}, Hg, Cd do not become residues and are not incinerated or dispersed of in landfills



From Cr^{VI} to Cr^{III} in conversion layers on Zinc and Zinc alloys



Sacrificial protection scheme

Use of these finishes

- Automotive Industry

- Fasteners

- Engine parts
- Chassis parts
- Interior parts

- Hydraulic tubes

- Brake fluids...

- Shock absorbing elements



- Other industries switched to Cr^{III}

- Building industry
- Wire industry

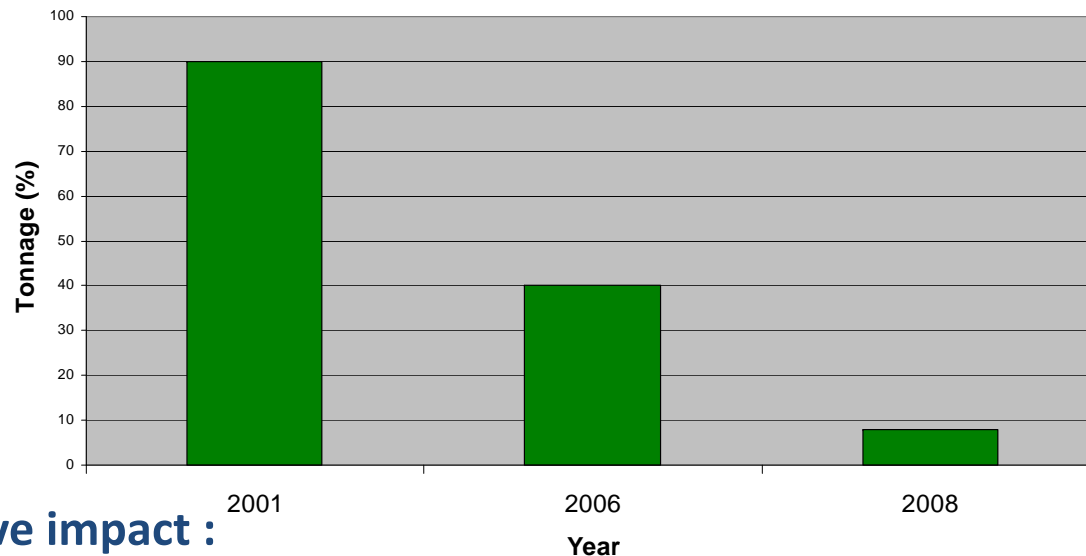


From Cr^{VI} to Cr^{III}

in conversion layers on Zinc and Zinc alloys

- **Switch over from CrVI to CrIII based technology :**

Tonnage evolution for CrVI passivates



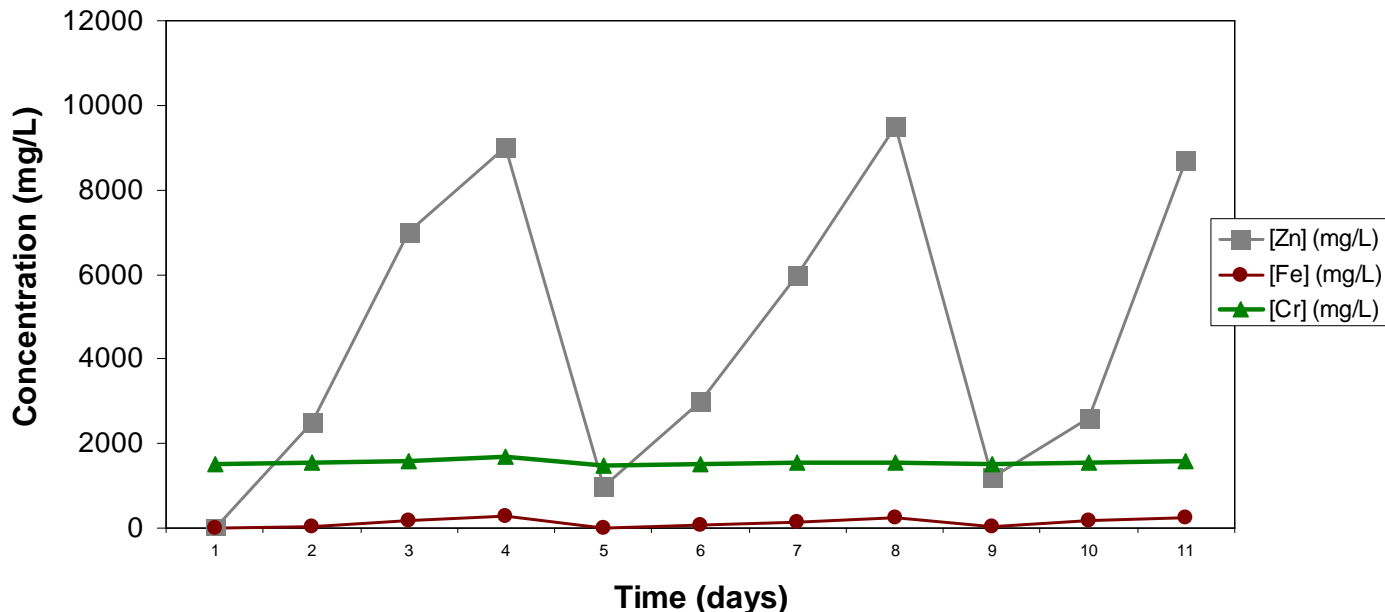
– **Positive impact :**

- Better thermal resistance
- Reduced water treatment costs
- Homogenization of aspect: black and silver
- Maintaining the same corrosion resistance (Salt Spray Test : ISO 9227) : up to 240 hours to white rust and 720 hours to red rust

Development of regeneration systems for Cr^{III} conversion electrolytes

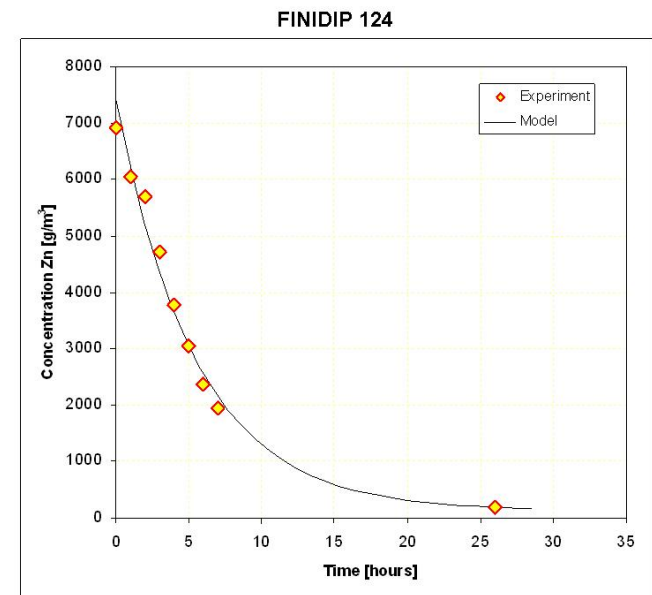
- Electrolytes are contaminated :
 - With Fe, Zn coming from the parts
 - Necessary to dump the bath and make up new ones

Contamination of a trivalent passivate



Impurities removal in Cr^{III} conversion electrolytes

- Precipitation followed by ion exchange resin:
 - Precipitation of zinc by chemical reaction
 - Filtration through ion exchange resins to remove iron
- Extraction Technology
 - Selective extraction of Zn and Fe while other components of the passivate remain constant
 - Low volume of effluent



Zinc/Nickel electrolytes equipped with electro dialysis system

Zinc Nickel is extensively used in the automotive industry:

- Anticorrosion properties superior to pure zinc
- Better behaviour in contact with Aluminium
- Wide application range (including small diameter screws)
- Electro dialysis system with ion exchange membranes (PMS) or with porous materials (3S system) separating anolyte and catholyte

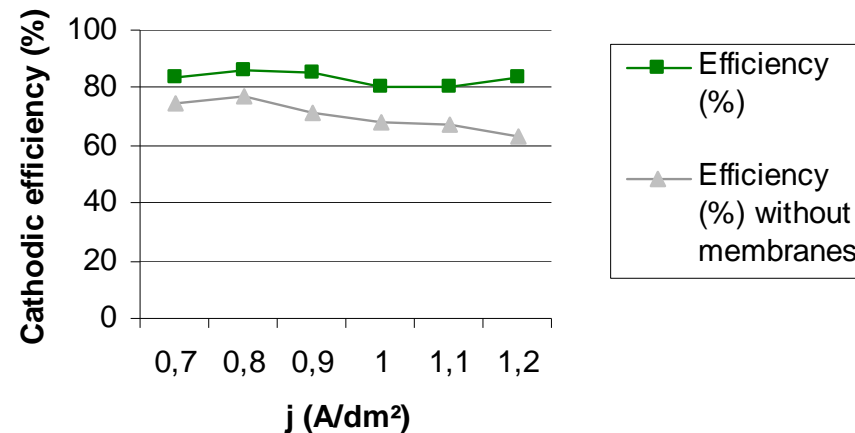


Zinc/Nickel electrolytes equipped with electro dialysis system

- Prevents generation of breakdown products (CN⁻)
 - Beneficial for water treatment
- Reduces accumulation of carbonates
 - Less maintenance operation (freezing for carbonate removal...)
- Maintain the bath at a high efficiency level:
 - 20% less working stations required for the same workload
 - Same quantity of electricity : up to 40% more alloy deposited



Evolution of an alkaline Zn/Ni electrolyte efficiency



Zn/Ni and Hydrogen embrittlement interactions

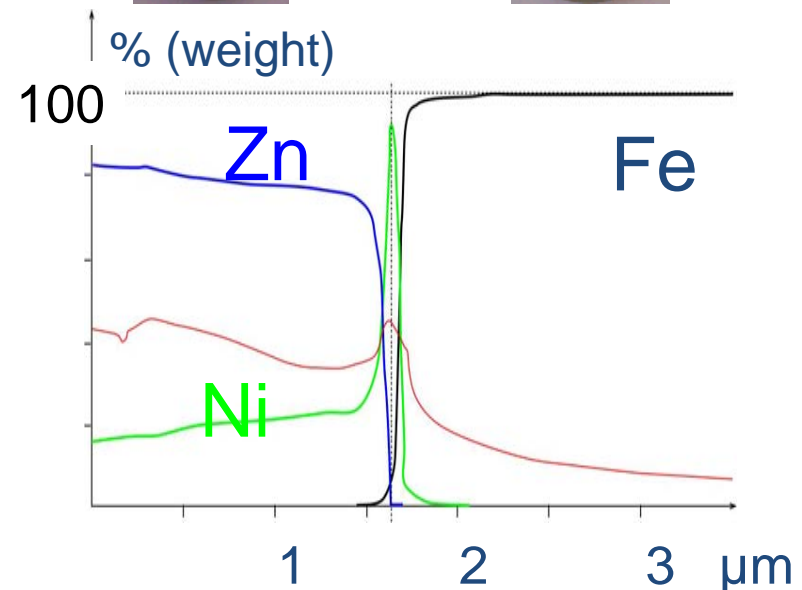
- High Strength steel $R_m > 1000$ MPa electroplated must be heat treated min 4h at 200°C
- University studies in France & Germany :
 - Zn/Ni gives less H embrittlement versus pure Zn
 - Thin Ni layer on steel allows for H recombination
 - Zn/Ni structure favours Hydrogen effusion

Target : avoid case by case non required heat treatment

Zn (alkaline)



Zn-Ni 12-15% (alkaline)

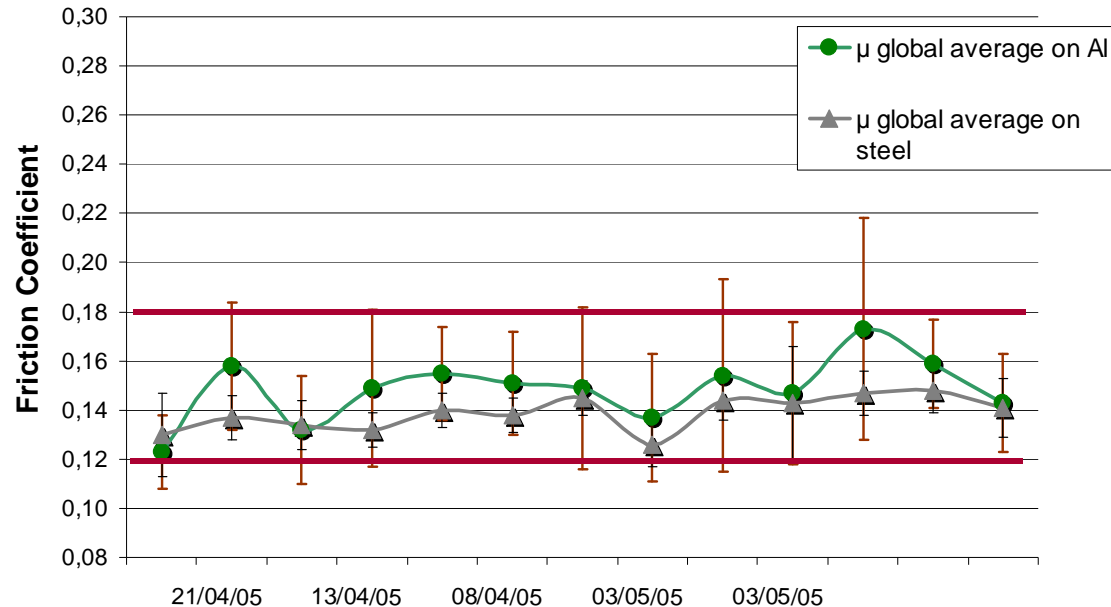


Control over coefficient of friction

Fasteners industry:

- Ca 760 000 Tonnes/year of fasteners are electroplated and top coated in Europe
- Automatic assembly is possible thanks to coefficient of friction monitoring
- C_f must be within the defined limits in contact with Steel, Aluminium...
- Fasteners are multi-purpose
- Assembly time is reduced
- Increase in productivity
- Reduction of musculoskeletal diseases

Approval of FINIGARD 150
Study from March to May 2005
Zinc Nickel Performa 280.5 + Finidip 128 + Finigard 150
H M10 Screws screwing on panel 2017AT4 with steel nut
Global friction coefficient (+/- 3 sigma)



Cleaning sequence and associated tensio-active agents

- **Biodegradability of surfactant used in detergency: regulation N°648/2004**
 - Environmental impact
- **Restriction on the marketing of Nonylphenol and Nonylphenol ethoxylated**
 - Impact on the whole electroplating industry
- **Directive 2006/122/EC on restriction on the use of PFOS**
 - Impact on mist suppressant for CrO₃ based solutions
- **Implementation of low temperature soak cleaners:**
 - 60°C down to 40°C
 - Energy savings: 10% energy saving on the whole preparation sequence



Impact of RoHS/WEEE directives

Electrical and Electronic Industries have banned the use of Cr^{VI}, Pb, Cd:

- Cr^{VI} passivates for plugs, chassis, etc...
- Electroless Nickel deposits:
 - For oil recovery, automobile
 - Development of Pb, Cd free process range
 - Now over 50% of overall Electroless Nickel additives tonnage correspond to Pb and Cd free processes
- Pure Sn processes to substitute Sn/Pb
 - Application in connectors
 - Whisker mitigated processes



Challenges: current and future



REACH: REGULATION (EC) N°1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

- **Registration**
 - From 1st of June 2008, every substance produced or imported > 1T/year : producer or importer must submit a registration file to ECHA
 - December 2010 : > 1000 T/year, CMR substances cat 1 and 2 > 1 T/year, R50/53 > 100 T/year
 - June 2013 : Substances produced or imported > 100 T/year
 - June 2018 : Substances produced or imported > 1 T/year
- **Evaluation**
 - Files conformity by the ECHA
- **Authorisation**
 - Substances submitted to authorisation will be in Annex XIV.
 - For the time being : we are surveying the candidate list
 - Looking for possible substitutes : eg : Sodium dichromate, Cobalt salts
- **Restriction**

Challenges: current and future

CLP:

- Classification of Nickel and Cobalt salts as CMR substances:
- High impact on surface finishing industry:
- Protective applications : ie on hydraulic tubes
 - Co containing passivates

LANTHANE TR 175 PREPARATION	LANTHANE 175 CF PREPARATION
(Proposition of classification of baths made up according to our technical recommendations)	(Proposition of classification of baths made up according to our technical recommendations)
LANTHANE TR 175 PART A : 90 – 180 mL/L	LANTHANE 175 CF PART A : 90 – 100 mL/L
LANTHANE TR 175 PART B : 70 – 110 mL/L	LANTHANE 175 CF PART B : 70 – 110 mL/L
(R 49- 34- 51/53)	
	
H 350i : May cause cancer by inhalation	H315 : Cause skin irritation
H 360 : May damage fertility or the unborn child	H319 : Cause serious eye irritation
H 411 : Toxic to aquatic life with long lasting effect	
H 314 : Cause severe skin burns and eye damage	

Challenges: current and future

- **Coventya is engaged in a 3 year common project including Automotive, Screw manufacturer, Job plater and University to find a substitute to Zn/Ni and Cr^{III} in conversion layers**
 - Application : on fasteners
 - Funded by the European Regional Development Fund
- **Decorative applications**
 - Alternatives to Nickel are in the development phase :
 - White bronze (Cu/Sn alloy)
 - Applications on decorative parts, on connectors...
 - Systems plated with Cr^{III} on plastic parts
 - On cellular phones, door handles, household appliances



Challenges: current and future

Functional

- Electroless Nickel systems with low Nickel concentrations < 3 g/L Nickel are available
- Applicable in automotive industry, oil recovery



Precious Metals

- Cyanide free systems are in development
- Applications in jewelery, fashion industry



Conclusions

Innovation in Surface Finishing is a key factor:

- To maintain competitiveness of European companies
- To provide surface treatments with high technology features
- To ensure sustainable development of our branch of activity
- To give a positive image of surface treatment activity

