Specific training on surface treatment

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Unioncamere Veneto – Eurosportello del Veneto, 15th June 2012
AGENDA

• Background
• Environmental issues
• Environmental services
• Closing remarks
• Q&A
**Surface treatment:** metals and plastics are treated to change their surface properties for: decoration and reflectivity, improved hardness and wear resistance, corrosion prevention and as a base to improve adhesion of other treatments such as painting or photosensitive coatings for printing.
Background

Surface finishing processes can be categorized by how they affect the workpiece:

<table>
<thead>
<tr>
<th>Adding and altering</th>
<th>Removing and reshaping</th>
<th>Mechanical finishing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanching</td>
<td>Abrasive blasting</td>
<td>Abrasive blasting</td>
</tr>
<tr>
<td>Case hardening</td>
<td>Sandblasting</td>
<td>Sandblasting</td>
</tr>
<tr>
<td>Ceramic glaze</td>
<td>Burnishing</td>
<td>Burnishing</td>
</tr>
<tr>
<td>Cladding</td>
<td>Chemical-mechanical</td>
<td>Chemical-mechanical</td>
</tr>
<tr>
<td>Electroplating</td>
<td>planarization (CMP)</td>
<td>planarization (CMP)</td>
</tr>
<tr>
<td>Galvanizing</td>
<td>Electropolishing</td>
<td>Electropolishing</td>
</tr>
<tr>
<td>Glazing</td>
<td>Flame polishing</td>
<td>Flame polishing</td>
</tr>
<tr>
<td>Knurling</td>
<td>Gas cluster ion beam</td>
<td>Gas cluster ion beam</td>
</tr>
<tr>
<td>Painting</td>
<td>Grinding</td>
<td>Grinding</td>
</tr>
<tr>
<td>Passivation/Conversion coating</td>
<td></td>
<td>Tumble finishing</td>
</tr>
<tr>
<td>Anodizing</td>
<td>Polishing</td>
<td>Vibratory finishing</td>
</tr>
<tr>
<td>Bluing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Table 9.1: Manufacture of basic metals and fabricated metal products (NACE Subsection DJ) 
Structural profile, EU-27, 2006 (1)

<table>
<thead>
<tr>
<th>Basic metals &amp; fabricated metal products</th>
<th>Enterprises (thousand)</th>
<th>Turnover (EUR million)</th>
<th>Value added (EUR million)</th>
<th>Persons employed (thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(%) of total</td>
<td>(% of total)</td>
<td>(% of total)</td>
<td>(% of total)</td>
</tr>
<tr>
<td>Basic metals</td>
<td>417.7</td>
<td>863 744</td>
<td>244 404</td>
<td>5 080.5</td>
</tr>
<tr>
<td>Iron, steel &amp; ferro-alloys; tubes; other first processing of iron &amp; steel</td>
<td>17.0 (4.1)</td>
<td>395 000 (45.7)</td>
<td>79 400 (32.5)</td>
<td>1 100.0 (21.7)</td>
</tr>
<tr>
<td>Precious &amp; non-ferrous metals</td>
<td>6.7 (1.6)</td>
<td>237 132 (27.5)</td>
<td>49 550 (20.3)</td>
<td>612.6 (12.1)</td>
</tr>
<tr>
<td>Casting of metals</td>
<td>3.6 (0.9)</td>
<td>120 298 (13.9)</td>
<td>17 845 (7.3)</td>
<td>221.5 (4.4)</td>
</tr>
<tr>
<td>Fabricated metal products</td>
<td>400.0 (95.8)</td>
<td>469 000 (54.3)</td>
<td>165 000 (67.5)</td>
<td>4 000.0 (78.7)</td>
</tr>
<tr>
<td>Structural metal products</td>
<td>121.7 (29.1)</td>
<td>123 086 (14.3)</td>
<td>40 839 (16.7)</td>
<td>1 116.7 (22.0)</td>
</tr>
<tr>
<td>Tanks, reservoirs &amp; containers; central heating radiators &amp; boilers; steam generators</td>
<td>14.8 (3.5)</td>
<td>42 820 (5.0)</td>
<td>14 207 (5.8)</td>
<td>316.3 (6.2)</td>
</tr>
<tr>
<td>Forming of metal; powder metallurgy; treatment &amp; coating of metals; general mechanical engineering</td>
<td>158.0 (37.8)</td>
<td>162 220 (18.8)</td>
<td>60 156 (24.6)</td>
<td>1 430.2 (28.2)</td>
</tr>
<tr>
<td>Cutlery, tools &amp; hardware; other fabricated products</td>
<td>106.3 (25.5)</td>
<td>141 004 (16.3)</td>
<td>49 677 (20.3)</td>
<td>1 113.0 (21.9)</td>
</tr>
</tbody>
</table>

(1) Rounded estimates based on non-confidential data.
Source: Eurostat (SBS)
Galvanic Plant

Hot dip
Background

CETS
European Committee for Surface Treatment
represents

22 members from 14 European countries

• Painting: 4 Associations
• Plating: 8 Associations
• Painting and Plating: 5 Associations 1 Institute
• Associated: 3 Associations
CETS

Sectors

- **Painting Section**: suppliers of equipment and appliers of organic coatings
- **Plating Section**: suppliers for chemistry and equipment and appliers of chemical and electrochemical surface treatment
CETS

The branches are:

• Chemical and electrochemical treatment of metal and plastics
• Physical and thermal metal coating
• Plants and equipment for organic coatings
• Plants and equipment chemical and electrochemical treatment
• Plants and equipment for mechanical plating
• Plants and equipment for physical deposition
• Pollution abatement for water and air
The aims are:

- Exchange of knowledge on health, safety and environmental issues
- Exchange of information on matters of statutory regulations
- Exchange of information on business statistics
- Aspire an European standardisation
- Observe market development and sales statistics
- Accomplish market research
Background

Italy: Assogalvanica

Source: Cefic Chemdata International
* Rest of Europe = Switzerland, Norway and other Central & Eastern Europe
Ecometal is a nonprofit consortium promoted by Assogalvanica and founded in 1994 by some member companies, with the input from the Environmental Council of the Veneto Region.

Environmental issues

Upstream - Environmental Impact - Downstream

- Raw materials
- Energy
- Other fuels
- Water

- Resources Depletion
- Surface Treatment

- Greenhouse Gases Emissions
- Ozone Depletion
- Water Emissions
- Soil Contamination
- Hazardous Waste
- Chemical Risk
- Air Emissions
- Toxicity, Acidity

Resources Depletion

Water
Environmental issues

Upstream

Raw materials
- metals used as soluble salts or anodes

Electricity
- electrolytic and electrochemical reactions
- operate plant equipment
- work space lighting
- cooling

Water
- base for several solutions
- cleaning

Other fuels
- heating processes and drying
- supplementary vat heating
- work space heating
Environmental issues

Downstream

Surface Treatment

Emissions to air
- GHG
- Noise
- Process emissions
- Ozone Depletion

Emissions to water
- waste water
Environmental issues

Air Emissions

**Toxicity, Acidity**
- Surfactants
- NOX, HCl, HF
- Acid particulates from pickling operations
- Hexavalent chromium
- Ammonia
- Dust

**GHG Emissions**
- Combustion
- Process Emissions

**Ozone Depletion**
- Direct and indirect

Water Emissions

**Toxicity, Acidity**
- Surfactants
- AOX
- Other ions (e.g. chlorides, sulphates, phosphates, nitrates and anions containing boron may be significant at a local level)
Environmental issues

Global positive trend

• Nowadays industry is much more controlled and subject to strict EU and National regulation
• Moreover the diffusion of management systems and international standards has increased dramatically the level of attention of managers and employees at all levels, together with voluntary programs adopted by industries (EcoMetal)
• Consumers are much more caring about environmental impact of products they buy, including toxicity and waste management related aspects
• Diffusion of environmental standards on the demand side, such as LEED standard for buildings, where credits are recognized if materials with high recycled content are used.
• Carbon Footprint allows to take into account ‘upstream’ related emissions (extraction, primary cycles, transport)
• Social aspects of metal extraction are more and more taken into account
## Environmental regulation

### Directives and Regulations

<table>
<thead>
<tr>
<th>Directive/Regulation</th>
<th>Description</th>
</tr>
</thead>
</table>
| EIA, SEA Directives  | Environmental Impact Assessment (85/337/EEC)  
                        Strategic Environmental Assessment (2001/42/EC) |
| Regulation REACH     | The Regulation (EC) n. 1907/2006 concerning the Registration, Evaluation, Authorisation and restriction of chemicals and the establishment of the European chemicals |
| Regulation CLP       | The Regulation (EC) n. 1272/2008 on classification, labeling and packaging of substances and mixtures |
| Directive 2008/99/EC  | This Directive establishes measures relating to criminal law in order to protect the environment more effectively. |
Environmental regulation

Standards and Voluntary programs

<table>
<thead>
<tr>
<th>Standard/Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9001</td>
<td>Quality Management System</td>
</tr>
<tr>
<td>ISO 14001</td>
<td>Environmental Management System</td>
</tr>
<tr>
<td>OHSAS 18001</td>
<td>Organization's occupational health and safety management system</td>
</tr>
<tr>
<td>Eco-metal</td>
<td>Environmental programme of the Italian Galvanization association</td>
</tr>
<tr>
<td>ISO 50001</td>
<td>Energy Management System</td>
</tr>
<tr>
<td>ISO 14064, ISO 14067</td>
<td>Carbon Footprint of an organization or product</td>
</tr>
</tbody>
</table>
Production units and/or logistics certified ISO 14001 and OHSAS 18001 in the chemical industry

Environmental regulation
Directive 2008/99/EC

- This Directive establishes measures relating to criminal law in order to protect the environment more effectively.

- Member States shall ensure that certain conduct damaging the environment constitutes a criminal offence, when unlawful and committed intentionally or with at least serious negligence.
Environmental regulation

Decree 121/2011

Decree 231/2001 introduced since 2001 a regulation of administrative liability on enterprises for certain offences, committed to its advantage.

In year 2011 (Decree 121/2011), certain environmental offences have been added, under the transposition of Directive 2008/99/CE.

Decree 231/2001 provides the exemption from this liability if the enterprise can demonstrate to have adopted and properly actuated an organization, management and control system, suitable for the prevention of such offences.

Environmental offences in Decree 121/2011 deal with:

• Habitat & protected species
• Water pollution
• Waste management
• Air pollution
• Sea pollution from ships
Environmental regulation

Decree 121/2011: how to respond

- Analysys of the risks to the environment associated to the production.
- Updating of the existing organisation.
- Implementation of a new organisation, compliant with the decree.
- Need for customized solutions.
- Big enterprises are more reactive and ready for acknowledgment than SMEs.
- ISO14001 or EMAS III Models can be a reference
Environmental services

Decree 121/2011: services

ANALYSIS & DESIGN
• Analisi / aggiornamento dei rischi ambientali
• Adeguamento / implementazione dei modelli organizzativi previsti dal D.Lvo 231/01, relativamente ai temi ambientali (da / fino a ISO14001 e/o EMAS III)

ACTIVATION AND MANAGEMENT
• Supporto nell’attuazione di quanto previsto dal modello organizzativo in materia ambientale

MONITORING AND SURVEILLANCE
• Partecipazione o supporto sui temi ambientali all’Organismo di Vigilanza
Decree 121/2011: expertises needed

- **Legal**: environmental legislation and associated jurisprudence.
- **Sistem theory**: HSE and EMS.
- **Environmental**: matrices and environmental processes.
Environmental Service about Toxicology

- Analysis of toxicity, Laboratory Analysis;
- Developing environmental standards;
- Toxicological evaluations (including tests pharmacokinetic data);
- Peer review of the toxicological basis of environmental standards;
- Hazards Identification (determination and identification of health impacts of chemicals);
- Dose-response assessment - determining the degree of exposure necessary to cause health effects, and quantification of a possible link between the degree of exposure (dose) and toxicity (response);
- Legal support.
Compliance with REACH:
• REACH audit
• Preparing for inspection of the competent authorities
• Support to countries outside the EU

Strategic Planning for REACH:
• Identification of the roles, obligations and deadlines of the company
• Inventories of Chemicals
• Communication along the supply chain

Assistance (administrative and technical) in SIEF and Consortia

Services of Third Party Representative (TPR)

Services related to testing and monitoring:
• Management of laboratories performing tests under REACH (chemical and physical tests, toxicological, ecotoxicological)
• Monitoring the quality of workplace
• Monitoring of environmental quality
Environmental Service about REACH

REACH registrations:
- Hazard assessment: assessing the quality of existing data (including the assignment of Klimisch score), missing data analysis, evaluation of the applicability of the "read-across" and (Q) SAR for the generation of new data, research literature, preparation of testing proposals and cost estimates, classification and labeling.
- Exposure assessment and risk assessment: modeling of occupational exposure and exposure of consumers and the environment (using software such as ECETOC TRA, RISKOFDERM, ART, Stoffenmanager, EUSES, Chesar).
- Preparation of technical dossiers: Chemical Safety Assessment (CSA), Chemical Safety Report (CSR) and Exposure Scenarios (ES), insert data in IUCLID 5.

Preparation, revision and updating of Safety Data Sheets (SDS) including the creation of Exposure Scenarios for Extended Safety Data Sheet (e-SDS).

Notification of substances of very high concern (SVHC) added in the "Candidate List".

Classification and labeling of

Notification / registration of chemicals in countries outside the EU (eg Turkey, China, Korea, Japan, Canada, Australia, USA).
Carbon Management

- Since the entering into force of the Kyoto Protocol in 2005, public and private entities started to monitor their CO2 emissions. In some cases this is due by law, such as for the EU Emissions Trading, in other cases it is part of a voluntary sustainability policy.

- Whatever the business or social driver, managing carbon is nowadays recognized as a general management best practice, allowing to reduce costs, improve supply chain management, reduce financial and legislative risks, and discover new business opportunities and new fast growing markets.
Knowing your impact on Climate is at the basis of any Carbon Management strategy. Several international standards are available according to which it is possible to define a calculation methodology and calculate your Carbon Footprint in a transparent and certifiable way.
The CRC Energy Efficiency Scheme (previously known as the Carbon Reduction Commitment) is a mandatory carbon emissions reporting and pricing scheme to cover all organisations using more than 6,000MWh per year of electricity (equivalent to an annual electricity bill of about £500,000).
<table>
<thead>
<tr>
<th>Gas ad Effetto Serra</th>
<th>Formula Chimica</th>
<th>GWP1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anidride carbonica</td>
<td>CO₂</td>
<td>1</td>
</tr>
<tr>
<td>Metano</td>
<td>CH₄</td>
<td>23</td>
</tr>
<tr>
<td>Protossido d’azoto</td>
<td>N₂O</td>
<td>296</td>
</tr>
<tr>
<td>HFC-23 (Idrofluorocarboni)</td>
<td>CHF₃</td>
<td>12000</td>
</tr>
<tr>
<td>HFC-134a</td>
<td>CH₂FCF₃</td>
<td>1300</td>
</tr>
<tr>
<td>Esafluoruro di zolfo</td>
<td>SF₆</td>
<td>22200</td>
</tr>
<tr>
<td>PFC-14 (Perfluorocarburi)</td>
<td>CF₄</td>
<td>6500</td>
</tr>
<tr>
<td>PFC-116 (Perfluorocarburi)</td>
<td>C₂F₆</td>
<td>9200</td>
</tr>
</tbody>
</table>

**Diagram:**

- **upstream scope 3 emissions**
  - **product A**
  - **material acquisition & pre-processing**
- **scope 1 and 2 emissions**
  - **production**
- **downstream scope 3 emissions**
  - **distribution & storage**
  - **use**
  - **end-of-life**
Carbon footprint of a zink coated product

Raw material extraction / Metal scrap collection → Log → Steel and rod production → Log → Zink product production phases → Log

Secondary products production → Log → Civil works → Log → Maintenance → Decommissioning

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## Difference among upstream processes

<table>
<thead>
<tr>
<th>Process</th>
<th>t CO2eq/t</th>
<th>IPCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc, Process: Pyrometallurgical (Imperial Smelting Furnace)</td>
<td>0.43</td>
<td>IPCC 2006</td>
</tr>
</tbody>
</table>
CF of a Zink Coated Product

Production of a zink coated product

- Natural gas consumption: 2,12%
- Electricity consumption: 13,82%
- Input material: 16,31%
- Input material transport: 0,88%
- Transmission & Distribution Losses: 66,88%
### Energy Audit – Surface Treatment Plant

<table>
<thead>
<tr>
<th>Tipologia misura</th>
<th>Descrizione misura</th>
<th>Costo stimatato</th>
<th>Risparmio stimato</th>
<th>PBT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>€/anno</td>
<td></td>
<td>anni</td>
</tr>
<tr>
<td>Produzione energia elettrica</td>
<td>Installazione di un sistema fotovoltaico da 113 kWp film sottile tellururo di cadmio (dati indicativi: vedasi offerta allegata).</td>
<td>420.000</td>
<td>60.000</td>
<td>8</td>
</tr>
<tr>
<td>Produzione energia termica</td>
<td>Installazione di un sistema solare termico per la produzione di acqua calda sanitaria e di processo, e per l'integrazione dei consumi per riscaldamento invernale. Il prezzo indicato è puramente indicativo e non supportato da un'offerta specifica.</td>
<td>40.000</td>
<td>18.000</td>
<td>2,2</td>
</tr>
<tr>
<td></td>
<td>Produzione di parte dell'acqua calda sanitaria di processo e per il riscladamento invernale mediante il recupero di calore dalla centrale aria compressa. Vedasi misure aria compressa.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Sistemi ausiliari</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Utilizzo durante le ore notturne del compressore 40 HP dotato di funzione ‘off’</td>
<td>0</td>
<td>2.000</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Individuazione e rimozione perdite mediante campagna misure ultrasuoni</td>
<td>1.000</td>
<td>8.000</td>
<td>0,1</td>
<td></td>
</tr>
<tr>
<td>Sostituzione dei due compressori 40 e 50 con un unico compressore a velocità variabile e dotato di kit recupero calore</td>
<td>30.000</td>
<td>16.500</td>
<td>1,8</td>
<td></td>
</tr>
<tr>
<td>Sfruttare illuminazione naturale pressi</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Retrofit lampade Master TL-D Eco</td>
<td>tbd</td>
<td>tbd</td>
<td>0,4</td>
<td></td>
</tr>
<tr>
<td>Sostituzione Corpi illuminanti con Apparecchi con reattori HF-Select</td>
<td>tbd</td>
<td>tbd</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Sostituzione corpi illuminanti e installazione Sistemi di Controllo</td>
<td>tbd</td>
<td>tbd</td>
<td>2,9</td>
<td></td>
</tr>
<tr>
<td>Totale senza impianto fotovoltaico</td>
<td>71.000</td>
<td>45.000</td>
<td>1,6</td>
<td></td>
</tr>
<tr>
<td>Totale misure tecnologiche</td>
<td>491.000</td>
<td>105.000</td>
<td>4,7</td>
<td></td>
</tr>
</tbody>
</table>
Emissions Trading

Assistance to those companies falling into the scope of the EU Emissions Trading System, as defined by Directive 2003/87/EC and its following amendments. The service a ‘turn-key’ assistance, adaptable to your specific needs; it includes:

- Assistance in obtaining, updating, revoking your emissions permits.
- Creation and updating of your Monitoring Plan
- Preparation of annual verification of emissions, assistance during third party audit
- Assistance to the Trading of your CO2 emissions, definition of a compliance strategy
- Assistance in Emissions’ registry operations
- Assistance in handling relations with Public Authorities and Verification Institutions
- Legislative updates