Current Global Trends for Titanium Applications Within the Chemical Process and Oil & Gas Markets

Regis Baldauff
Market Director, T.I. Industrial
9855 – 1 Mining Drive
Jacksonville, FL 32257
Presentation Overview

- Industrial Markets
- New Industrial Market Focus
- Chemical Process Industry (CPI) Trends
- Oil & Gas Market Trends
- Future of Industrial Market
Recent Global Events

- 2008-2012 Global Recession
- Deepwater Horizon, 2010
- Fukushima Nuclear Plant 2011
- West Texas Fertilizer Plant 2013
Focus Shift

- Increase Material Performance
- Material selections
- Corrosion Issues
- Metal Fatigue
- Higher Temperature Demands
- Increased paperwork Scrutiny
- Specification Revisions
- Additional NDT testing
- PMI
- Increase Life Cycle Times
- Industry Collaboration

CPI Expansion Plans
97 Chemical Projects have been announced as of March 2013 in the US. 50 of the 97 are by foreign controlled companies & represents 51% of the estimated capital investments.

Cumulative Capital Investment $71.7 Billion USD through 2020.

Global Chemical Growth in 2014 estimated at 3.8%. Up from 2.3% Growth in 2013.

US CAPEX Investment by Region:
78% in the Gulf Coast
13% Ohio Valley
8% Mid west
1% Other

$71.7 billion investment will lead to $66.8 billion in increased CPI output. A 9% Gain.

258,000 jobs in firms that supply materials, equipments & services involved in the build out.

Source: ACC May 2013
<table>
<thead>
<tr>
<th>Asset Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Residential Construction</td>
<td>38%</td>
</tr>
<tr>
<td>Major Process Equipment</td>
<td>26%</td>
</tr>
<tr>
<td>Building Construction</td>
<td>10%</td>
</tr>
<tr>
<td>Engineering Services</td>
<td>9%</td>
</tr>
<tr>
<td>Process Instrumentation</td>
<td>8%</td>
</tr>
<tr>
<td>Piping and Valves</td>
<td>5%</td>
</tr>
<tr>
<td>Electrical wire &amp; Conduit</td>
<td>4%</td>
</tr>
</tbody>
</table>

Source: ACC May 2013
Share of Incremental Gain in Production of Chemicals Excluding Pharmaceuticals 2012-2020

- China 54%
- United States 17%
- Other Asia Pacific 14%
- Africa & the Middle East 5%
- Latin America 4%
- Central & Eastern Europe 3%
- Japan 2%
- Other NAFTA 2%
- Western Europe 1%

Source: ACC May 2013
Composition of New Capital Investment by CPI Segment

- Bulk Petro Chemicals 55%
- Plastic Resins 22%
- Fertilizers 14%
- Other 5%
- Inorganic Chemicals 4%

Source: ACC May 2013
Oil Production/Consumption by Region
Millions barrels Daily

Production by region
- Asia Pacific
- Africa
- Middle East
- Europe & Eurasia
- S. & Cent. America
- North America

Consumption by region

Source: 2013 BP Statistical Review of World Energy
Subsea Expenditures

- Deepwater production to double
- Capex up 179% by 2015
- $205 billion Capex over the next five years
- Drilling $72bn (35%). Subsea processing emerging ($2.6 bn)

Source: Douglas Westwood May, 2011.
Expanding Product Lines

Core Products
- Trees
- Manifolds
- Control Systems
- Template Systems
- Flowline Connection Systems

New Products
- Subsea Processing
  - Separation
  - Boosting
  - Gas Compression
- Well Intervention Services

Performance metal solutions.
Product Failure, not an Option

- Estimated $1 million USD to bring up a malfunctioning component off of the sea floor.
- Or, € 725,850.00
- Material or process failures are costly.
- Reliability Tools & Life Estimation

- Design Considerations.
- Application Of Reliability tools (Fault Tree Analysis )
- Materials Compatibility & Accelerated Aging Program
- Prototyping and Validation tests to reduce risk
- Qualification testing
- Systems Testing

Performance metal solutions.
Reliability Science & Engineering

Physics
- Molecular Structure Analysis

Materials
- Material Testing and Analysis

Components
- Contact Level Stress Analysis

Products
- Connector Level Accelerated Testing

Systems
- Reliability Block Diagram Analysis

Customer Integration
- Reliability Partnerships

Reliability Philosophy

Source: T. O & G
$16bn Kaombo project gets go ahead. Total and its partners are to move ahead with the 650MM bbl, deepwater Kaombo project offshore Angola after cutting US$4 billion from the capex costs on the project.

Kaombo will develop six of 12 discoveries made in Block 32, covering 800sq km, through 59 subsea wells, connected to two floating production vessels. It will make use of "hybrid loop" technology for multiphase pumping and transport of fluids.

Total said capex costs to reach full capacity on the 230,000 bbl/d potential development were reduced by $4 billion, to $16 billion. Start-up is expected in 2017.

Source: OE April 2014.
TITANIUM ADVANTAGES

- Higher Mechanical Strength (Cu-Ni)
- Light Weight (Low Density) .163
- Thermal Expansion - Close to Steel
  [= Lower Stress at Connections]
- High Shock Resistance - Over 4X Cu-Ni
- Very High Erosion Resistance - High Hardness with a Ceramic-Like Stable Surface Oxide
- Greater Water Flow Volume & Higher Velocities to 20X Cu-Ni
- Compatible with Composites
- Corrosion Immunity – All Seawaters; MIC & Stagnant Waters; Wet Chlorine & No Pitting.
- Lifecycle cost savings.
- Readily Available in grade 2 products
- Excellent Weldability (Robust, proper shielding)
**108,300 in Attendance. Highest in Show History

**Up 3.3% from 2013.

**2568 Companies exhibiting

**43 countries Represented

**International Companies made up 44% of exhibitors

**Sold Out Exhibition

**Sold Out Exhibition space 680,025 Sq. ft. Largest in history
## Current Rig Count

### Rig Count

<table>
<thead>
<tr>
<th>Location</th>
<th>April 25, 2014 Count</th>
<th>Change from 1 Year Prior</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>1861</td>
<td>+107</td>
</tr>
<tr>
<td>Canada</td>
<td>168</td>
<td>+46</td>
</tr>
<tr>
<td>International*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As of Dec 2013</td>
<td>1345</td>
<td>+77</td>
</tr>
</tbody>
</table>

* Iraq is included in the international rig count effective June 2012
Competitive Threats

- Substitute products are readily available.
- Super Duplex Stainless. More Complex to weld.
- Duplex Stainless
- FRP pipe for CLO2 applications. Readily available in large OD pipe. Maintenance & length issues.
- PE, PP, PVC pipe and fittings
Emerging Markets

• Alternative Biofuels
• Fuel production from optimized Algae.
• Combine Algae, salt water and CO2 and sunlight. Spent Algae is produced into crude oil.
• Wastewater Treatment Facilities.
Renewable Energy Consumption/Share Power by Region

Other renewables consumption by region
Million tonnes oil equivalent

- Asia Pacific
- Africa
- Middle East
- Europe & Eurasia
- S. & Cent. America
- North America

Other renewables share of power generation by region
Percentage

Source: 2013 BP Statistical Review World Energy
Takeaways

- **Titanium Advantages & Industry Demands**
  - Increased Performance Demands for materials
  - Maintenance Reduction
  - More NACE MR-01-75 requirements
  - More Global requirements (NORSOK M-650)
  - Legible certification documents required
  - Signed documents required
  - Life Cycle Cost Savings
  - Compatible with Composites
  - More Third Party NDT testing.
  - Increased levels of customer collaboration.