Kompakte und effiziente Hochstromverbindungen in Industrieanlagen

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The Company

Industry

Data Center

Railway

Key markets

About Superconductors

Power Grids

H2 Electrolysis
COMPANY - PIONEERS IN ELECTRIC POWER

- Starting 2014 by experienced industrial leaders with successful and proven track history

- Technology leader in superconducting high current applications worldwide

- Engineering, Design, Procurement, Assembly, Installation, Project Management: we transfer customer's need into solutions.

- System integrator – combining existing methods and material into a system.
Superconductors – break-even

- **Cu / Al – Conductor**
  - Ohm Losses
    \[ P_V = I^2 x R; \ R = f(T) \]
  - Contact resistance
    \[ R_K = f(t) \]

- **Super Conductors**
  - Current Lead
  - thermal losses:
    \[ P_T = f(A) \]
  - Efficiency of the cooling unit

**Conductor Costs**
- Cu: 50 – 60 €/kAm
- Al: 14 – 20 €/kAm
- SC: 80 – 100 €/kAm

**VESC business area:**
- above 10 kA
- above 20 m
Applications for Industry Plants

### Chlorine Plant
- Typical Current: approx. 20 kA
- Length: 30 - 300 m

### Data Centers
- Typical Current: 15 - 40 kA
- Length: 40 - 500 m

### Copper Electrolysis
- Typical Current: 40 - 80 kA
- Length: 200 - 400 m

### Zinc Electrolysis
- Typical Current: 120 - 200 kA
- Length: 100 - 300 m

### Aluminium Plants
- Typical Current: 200 - 350 (500) kA
- Length: 100 - 1200 m

And all other electrolysis and high current plants like Na, Mg, F, Electro Furnace, Graphite, etc.

Chlorine plant, 20 kA

Aluminium Smelter, 200 kA

Zincoelektrolysis, 200 kA
Chlorine plants

• Typical 15-20 kA @ +/- 200-250 V DC
• Membrane cells producing chlorine, hydrogen and caustic soda
• One unit includes two electrolyzer cells in series
• Two up to 16 units in parallel in one plant
Chlorine Plant – Use Cases

- Case collector bars
- Case return bars
- Case remote location of rectifiers
Case collector bars (1st example from the past)
Case collector bars (1st example from the past)

- Chlorine plant outside Europe
- 275,000 tons of annual chlorine production capacity
- 3 x 75 kA @ +/-250 V
- Loss ~ 270 kW, ~2,4 Mio. kWh
- Prize per kWh is about 5…15 ct
Case return bars (example form the presence)

- 3S- Project as demonstrator for SC-DC bus bars in chlorine plant
- Partners: BASF – KIT- VESC – ILK- PTJ – BMWI
- SC-length ~ 20 m, nominal current 20 kA
- LN2 circulation, 4 GM-coolers
- 1 pump for liquid nitrogen @ 70 K
- Cool down Jan. 2020
- After 20 h „cold head stall“
- Warm up

Mo., 02. March 2020 cold head is repaired and reinstalled
Aluminium plants

- Typical 200 - 400 kA @ 800-1500 V DC
- Reduction pots with molten cryolite at a temperature of 960-970°C
- Potlines with 50 - 200 pots in one row
- Typical two rows in parallel as a pair
- Typical several pairs in parallel
- Production 60000 – 100000 tons of aluminium per potline per year
Aluminium Plant – Use Cases

- Busbar Bridge
- Magnetic Field Compensation
- Interconnection
- Collector Bars

Distance: 50 - 300 m

Return Busbar: 300 – 600 (1200) m
Aluminium Plant – Return Busbar

Aluminium plant in Hamburg (130,000 tons/year) – Operating Cost Reduction
DEMO 200

- Demonstrator for 200 kA DC
- Preparation for TRIMET aluminium plant
- Lighthouse project
- Worldwide highest current with ReBCO
- Installation in industrial plant
DEMO 200 challenges

- 200 kA current leads (1)
- Interface (4) between current lead (1) and bus bar (2) with pressure tight feed through
- Short piece of bus bar (2) and coupling (3) with soldered face to face multilink between SC stacks
- Innovative cooling system (7) without any moving part in cold areas of LN2 with equal temperature distribution to SC
- Stratification of LN2 from 70 K to 77 K
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