Electromagnetic pulse technology (EMPT).
Keys for allocating the industrial market segment

R. Schäfer, P. Pasquale
Products and services

- **Product and specific tool development** with the target of substitution of your joining, welding or forming processes with the EMPT

- **Engineering, numerical simulation and development** of solutions for the usage of EMPT with the focus of cost reduction and technical optimisation of your product

- **FEM Analysis** (Process, Tools and Applications in service)

- **Conception, development and production of specific lightweight and hybrid structures**

- **Compilation of „ready to manufacture“ systems with technical service**

- **Realisation of prototypes and mass production** of your products in our plant
Business units

EMPT systems

- high speed EMPT systems
- Special coils
- EMPT multiple coil technique
- Pharma packaging systems
- ...

Engineering and Prototyping

- Cockpit carriers
- Drive shafts
- Crash management (crash boxes)
- EMPT filter housings
- ....
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Competitive processes
Competitive processes

- No auxiliary materials (gases/filler wire)
- Robust process
- No sophisticated quality insurance
- Fast process
- No heat affected zones
- Easy to control
- PST offers Pay per Pulse option

- Mid to High investments

- Low to high investment
  (manual welding-automated welding)

- Need for gases/filler wire
- Demanding process
- Sophisticated quality insurance
- Slow process
- Heat affected zones

Source: Reis Robotics
Competitive processes

- No auxiliary materials (gases/filler wire)
- Robust process
- No sophisticated quality insurance
- Fast process
- No heat affected zones
- Easy to control

Mid to High investment

- Field shaper

- Flexibility
- Coil life time
- Capacitor life time
- Switch life time
- Production rate
Field shaper

Coil (schematic)

Induced surface current

Forming zone

Fieldformer (2 slot type, upper half masked)
Field shaper
Competitive processes

- No auxiliary materials (gases/filler wire)
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- No sophisticated quality insurance
- Fast process
- No heat affected zones
- Easy to control

- High investment

- Flexibility
- Coil life time
- Capacitor life time
- Switch life time
- Production rate

Self reinforcing coils
Coils

AA 6060 tube
rotation symmetry

Copper coil winding

 Ø 10

 Ø 40

Bitter-magnet

cooling water
current

copper plate
insulator

Source: Radboud University Nijmegen
PSTproducts EMPT coils

Compression coils
Single winding, 2,3 and more windings
Life time 2.000.000 pulses

Expansion coils
High efficiency, high life time

Multiple joining coils
Single & multi winding
Life time: up to 2.000.000 pulses

Special coils
Cutting, forming, welding…
EMPT Systems PSxx BlueWave Series

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>PS8-16/25 to PS32-16/25</th>
<th>PS48-16/25 to PS96-16/25</th>
<th>PS112-16/25 to PS160-16/25</th>
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</thead>
<tbody>
<tr>
<td>switchable banks</td>
<td>up to two</td>
<td>up to six</td>
<td>up to ten</td>
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<tr>
<td>normal rated discharge energy</td>
<td>8kJ to 32kJ</td>
<td>48kJ to 96kJ</td>
<td>112kJ to 160kJ</td>
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<tr>
<td>charging voltage</td>
<td>16kV or 25kV</td>
<td>16kV or 25kV</td>
<td>16kV or 25kV</td>
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<tr>
<td>normal rated discharge current</td>
<td>up to 320kA</td>
<td>up to 960kA</td>
<td>up to 1600kA</td>
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<tr>
<td>(repetitive)</td>
<td></td>
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<tr>
<td>max peak current</td>
<td>up to 480kA</td>
<td>up to 1440kA</td>
<td>up to 2400kA</td>
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<tr>
<td>short cut current (non repetitive)</td>
<td>up to 800kA</td>
<td>up to 2400kA</td>
<td>up to 4000kA</td>
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<tr>
<td>pulses per minute</td>
<td>up to 12</td>
<td>up to 12</td>
<td>up to 12</td>
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<tr>
<td>cable length (standard)</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
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<tr>
<td>switching technology</td>
<td>mercury free, long life</td>
<td>mercury free, long life</td>
<td>mercury free, long life</td>
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<tr>
<td></td>
<td>industrial switches</td>
<td>industrial switches</td>
<td>industrial switches</td>
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<tr>
<td>number of pulses with one switch set</td>
<td>up to 400 000</td>
<td>up to 400 000</td>
<td>up to 400 000</td>
</tr>
<tr>
<td>process control</td>
<td>LAN and/or VPN</td>
<td>LAN and/or VPN</td>
<td>LAN and/or VPN</td>
</tr>
<tr>
<td>life time capacitor</td>
<td>2 to 2.5 millions</td>
<td>2 to 2.5 millions</td>
<td>2 to 2.5 millions</td>
</tr>
<tr>
<td>number of joints per pulse</td>
<td>depends on coil concept : 1 to 20 joints</td>
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</tr>
<tr>
<td>dimensions (without tooling space)</td>
<td>800 x 1200 mm</td>
<td>1600 x 1200 mm</td>
<td>1600 x 2400 mm</td>
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<tr>
<td>price</td>
<td>on demand</td>
<td>on demand</td>
<td>on demand</td>
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January 2010
Competitive processes

- No auxiliary materials (gases/filler wire)
- Robust process
- No sophisticated quality insurance
- Fast process
- No heat affected zones
- Easy to control

- Mid to High investment significant reduction of processing cost per part

- ? Flexibility
- ? Coil life time
- ? Capacitor life time
- ? Switch life time
- ? Production rate

Multiple joining coil (Mjo)
Multiple Joining Coil
(MJo Coil)

Features:

- multiple joining and forming of up to 600 workpieces per minute
- Bespoke development for mass production in the automotive, pharma and packaging industry sectors
EMPT Systems PSxx Series

Customer: BOSCH

Product: Injection pipes for common rail diesel engines

Units per year: 2,000,000
EMPT Systems PSxx Series
EMPT automotive aggregates
Electromagnetic Pulse Crimping

Steel to steel
St52
WT 2,5mm
Diameter 35mm
Hybrid cockpit carrier

Courtesy of Audi

Magnesium tube
Aluminium node
EMPT imprint for cable duct
Mild steel tube
EMPT automotive structures

Deformation elements (crash boxes) by PSTproducts
Electromagnetic Pulse Welding (EMPW)

PS100 System at ITU
Institute for Transuraniums

ODS: Oxide dispersion strengthened steel
Sales Options

1. **Classic sale** of a system:
   Pulse generator, coil, fixture (up to semi-automatic)

2. **Pay Per Pulse:**
   The pulse generator will be supplied **inclusive maintenance and spare parts** over 5 years. A monthly minimum number of pulses is required. Monthly bills. Optional purchase after 24 months.

3. **Leasing with subsequent option to purchase:**
   As Topic 1, but financed via a financial partner of PSTproducts GmbH. For machines in a Technical Centre PSTproducts offers to include an engineering hours call-off contract.
Thank you!

The Industrial Application of the Electromagnetic Pulse Technology (EMPT)
International Conference and User Meeting
including Tour of Production Facilities and Demonstration

22 April 2010, Alzenau, Germany

English / German with simultaneous translation

www.pstproducts.com