Technologies & Products Press Conference 2014

CeraPlas™
A new kind of piezo-based cold plasma generator

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November 12, 2014
Plasma has a wide spectrum of potential uses!

**Surface modification**

**Plasma requirements**
- Cold temperature
- Atmospheric pressure
- Air as process gas

**Cleaning and purifying**

- Adhesion
- Laminating
- Water repellance
- Food
- Wound healing
- Cavities

Plasma has a wide spectrum of potential uses!
Challenges for plasma sources

<table>
<thead>
<tr>
<th>Drawbacks of grid-connected sources</th>
<th>Requirements for future sources</th>
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</thead>
<tbody>
<tr>
<td><strong>High-voltage sources</strong></td>
<td>• No high-voltage cables or connectors</td>
</tr>
<tr>
<td>• High input power (&gt;100 W to 10 kW)</td>
<td>• Low plasma temperature</td>
</tr>
<tr>
<td>• High plasma temperature</td>
<td>• Compact size</td>
</tr>
<tr>
<td>• Large size</td>
<td>• Low power</td>
</tr>
<tr>
<td><strong>RF sources</strong></td>
<td>• Suitability for battery-driven, handheld devices</td>
</tr>
<tr>
<td>• High input power (10 to 2000 W)</td>
<td>• Atmospheric pressure</td>
</tr>
<tr>
<td>• High plasma temperature</td>
<td>• Easy handling</td>
</tr>
<tr>
<td>• High operating frequency</td>
<td>• Ability to use different process gases</td>
</tr>
<tr>
<td>• Large size</td>
<td>• High efficiency (ozone generation rate)</td>
</tr>
<tr>
<td><strong>Dielectric barrier discharge sources</strong></td>
<td></td>
</tr>
<tr>
<td>• High voltage source</td>
<td></td>
</tr>
<tr>
<td>• Constant distance required</td>
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</table>
CeraPlas™ enables compact cold plasma solutions

CeraPlas is an ideal component for generating cold plasma

- Voltage supply and plasma generation combined in a single component
- No special plasma generating electrode required
- Ignition directly in air or in industrial gases (e.g. Ar, N₂, He)
- No high-voltage plugs or cables needed
- Low plasma temperature (< 50 °C)
- High ozone generation rate
- Smaller and lighter and therefore well suited for handheld devices
Combined voltage supply and plasma generator

High voltage generation
- A single piezoelectric component generates high voltage in minimum space
- Vibrating system with mechanically coupled input and output sides for the transformation of low input voltage to high output voltage

Plasma generation
- Dielectric barrier discharge process on output electrode
- Electrical discharge between two electrodes separated by an insulating dielectric barrier by applying an alternating voltage
Fixation for optimum efficiency

**Challenge**
Create a reliable electrical connection and mounting without damping

Mounting at the nodal points of mechanical displacement leads to optimum efficiency.
Driver specially developed for CeraPlas

- Optimally matched to requirements of plasma generator
- New feedback control:
  - Compensation of transformer’s input impedance for higher sensitivity and stability
- Miniaturized design
- Efficiency > 85% by using SMPS
- Operating frequency at parallel resonance
- Rapid regulation of load changes
- No hard switching

CeraPlas driver enables plug-and-play solutions.
CeraPlas features a more effective surface activation than conventional techniques at a very low power input.
## Component and module for plasma generation units

<table>
<thead>
<tr>
<th></th>
<th>CeraPlas™ component</th>
<th>CeraPlas™ module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output voltage [kV]</strong></td>
<td>Up to 15 (depending on load)</td>
<td></td>
</tr>
<tr>
<td><strong>Input voltage [V]</strong></td>
<td>12 to 24 [V&lt;sub&gt;pp&lt;/sub&gt;]</td>
<td>12 to 15 [V]</td>
</tr>
<tr>
<td><strong>Dimensions [mm]</strong></td>
<td>72 x 6 x 2.8</td>
<td>72 x 6 x 2.8 (CeraPlas™) 100 x 25 (Driver)</td>
</tr>
<tr>
<td><strong>Max. transferred power [W]</strong></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Operating frequency f&lt;sub&gt;op&lt;/sub&gt; [kHz]</strong></td>
<td>~ 50</td>
<td></td>
</tr>
<tr>
<td><strong>Plasma temperature</strong></td>
<td>&lt; 50 °C</td>
<td></td>
</tr>
<tr>
<td><strong>Process gas</strong></td>
<td>Air and other industrial gases, e.g. N&lt;sub&gt;2&lt;/sub&gt;, Ar, He</td>
<td></td>
</tr>
<tr>
<td><strong>Ozone generation rate</strong></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Hard PZT with copper electrodes</td>
<td></td>
</tr>
<tr>
<td><strong>Terminal</strong></td>
<td>Solderable outer termination</td>
<td>Plug connector to power supply</td>
</tr>
<tr>
<td><strong>Assembly</strong></td>
<td>Soldered and connected at nodal points</td>
<td>Plug-and-play</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td><strong>Ex stock</strong></td>
<td><strong>On request</strong></td>
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First product featuring CeraPlas™

New piezobrush PZ2 from relyon plasma
- Extremely efficient plasma generation
- Multiple process gases
- Low plasma temperature
- Very robust and reliable
- Compact design
- More efficient performance than low pressure plasma chambers
- High power density

First proof of benefits on a system level
## Contact details

<table>
<thead>
<tr>
<th>The Netherlands</th>
<th>Belgium</th>
<th>UK &amp; Ireland</th>
<th>Nordic region</th>
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<tbody>
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<tr>
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<th>Germany South</th>
<th>Austria</th>
<th>General information</th>
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<tbody>
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