Effiziente Veredlung von Vliesstoffen mit Plasma- und Sprühsystemen

Efficient finishing of nonwovens with plasma- and spray-systems
Products

Corona treater

Spray coaters

Hot air dryers
Web Process Line
Corona Treatment of PP-Nonwoven
What is a Plasma?

Plasma is a gaseous mixture of ions, electrons, and atoms or molecules.
Corona = air-DBD

Working Principle

„Corona-Light“ in the discharge gap
8 ceramic electrodes / roller with ceramic coating

High Voltage Electrodes

Grounded Counter Electrode
Air-DBD on PE Oxidation & Fragmentation

Oxygen

(CH₂)ₙ Polymer chain (Surface of PE)

Fragmentation

Oxidation

Polymer chain with oxygen groups
Effect of air-DBD on Plastic Film

Oxygen groups linked to the surface result:
Improvement of wetting and adhesion properties

Crosslinking of polymer chains result:
increase of melting point and weaker sealing properties

Number of oxygen atoms on the surface

<table>
<thead>
<tr>
<th>Condition</th>
<th>Oxygen Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP without corona</td>
<td>No oxygen</td>
</tr>
<tr>
<td>PP corona treated</td>
<td>max. 30 O-Atoms per 100 C-Atoms</td>
</tr>
<tr>
<td>Formation of OH groups</td>
<td>1 – 5 %</td>
</tr>
</tbody>
</table>

Types of oxygen groups

<table>
<thead>
<tr>
<th>Type</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroxy</td>
<td>-OH</td>
</tr>
<tr>
<td>Acid</td>
<td>-COOH</td>
</tr>
<tr>
<td>Keto</td>
<td>-C=O</td>
</tr>
<tr>
<td>Aldehyd</td>
<td>-CH=O</td>
</tr>
<tr>
<td>Peroxide</td>
<td>-OOH</td>
</tr>
</tbody>
</table>
Absorption of Water on PET Nonwoven

without Corona-Treatment

0, 5 sec  1 sec  3 sec  5 sec

with Corona-Treatment

0, 1 sec  0,5 sec  0,7 sec  1 sec
Test inks on non woven

Polyolefin non woven 60 g/m²
without corona treatment

Test ink 34 mN/m

Test ink 40 mN/m
Air-DBD with high intensity on PP-Fibre

Increase of roughness due to fragmentation reactions

untreated

Air-DBD treated with ≈1000 W/min*m²
The corona/plasma dose represents the proportion of energy applied to a certain surface area.

\[ D = \frac{P}{WW \cdot V} \]

<table>
<thead>
<tr>
<th>Term</th>
<th>Formula Symbol</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Corona Dose</td>
<td>D</td>
<td>Wmin/m²</td>
</tr>
<tr>
<td>Power</td>
<td>P</td>
<td>W</td>
</tr>
<tr>
<td>Working Width</td>
<td>ww</td>
<td>m</td>
</tr>
<tr>
<td>Speed</td>
<td>v</td>
<td>m/min</td>
</tr>
</tbody>
</table>

Example:
3000 W / (1.5 m x 50 m/min) = 40.0 Wmin/m²
Influence of corona dose on absorption of test inks

<table>
<thead>
<tr>
<th>Corona-Dose [W*min/m²]</th>
<th>Test Ink Type [mN/m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td>200</td>
<td>36</td>
</tr>
<tr>
<td>400</td>
<td>38</td>
</tr>
<tr>
<td>600</td>
<td>40</td>
</tr>
<tr>
<td>800</td>
<td>42</td>
</tr>
<tr>
<td>1000</td>
<td>44</td>
</tr>
</tbody>
</table>

Spunbonded PP 33 g/m²
Influence of corona dose on water absorption after dipping

Spunbonded PP 33 g/m²

Corona-Dose [W*min/m²]

Water Absorption [%]
Decay of surface tension with time

Decay depends on additives and polymer type
Rotor Spray System

Beschichtung und Befeuchtung
Coating and wetting
Video Rotor Spray System
Hydrophilic Finishing of PP-Nonwoven
Hydrophilic Finishing of PP-Nonwoven

Material: Spunbonded PP 33 g/m²

Process steps
1) One sided air-DBD (on and off)
2) One sided spray of hydrophilic agent
   0,15 - 3 % wt % ingredient
   6 - 15 wt% wet
3) Hot air drying (> 10 % wet)
Influence of air-DBD on absorption of blue water

Spunbonded PP 33 g/m²

Without finishing

0.4 wt% hydrophilic agent

One sided air-DBD + 0.4 wt% hydrophilic agent
Influence of corona treatment on absorption of water

Spunbonded PP 33 g/m²

Without finishing  0,4 wt% hydrophilic agent  One sided air DBD + 0,4 wt% hydrophilic agent
Less hydrophilic agent with corona treatment

Spunbonded PP 33 g/m²

Absorption time [s]

Add-on of hydrophilic agent [wt.-%]

- with air DBD
- without air DBD
Hydrophobic Finishing of Glass-Fibre Fleece
Hydrophobic finishing of GF-Fibre Material

**Process steps**

1) Two sided corona treatment (air DBD)
2) One sided application of sol solution with rotor spray (≥ 100 wt %)
3) One sided smoothing with driven roll (add on side)
4) Hot air drying
Hydrophobic finishing of GF Process Steps

- Two sided corona treatment (air DBD)
- One sided smoothing
- One sided spraying
- Hot Air Drying
Influence of smoothing roll
Spray of red colour on paper

Without smoothing

With smoothing
Bifunctional finishing

PET non-woven 68 g/m²
One side spray application with blue agents
What can be sprayed

- Water based liquids with low viscosity
- Solutions, emulsions, dispersions (< 5 µ)
- Low and middle viscous oils

Examples

- Antimicrobials
- Hydrophilic
- Ammoniumsalts
- Glycols

Antimicrobials & Hydrophobic

- Sol/Gel-Systems
- Microcapsules
Pilot Plant in Lauterbach /Hessen

Test your material
Come to Lauterbach!

Thank you for listening
At your disposal for any Questions