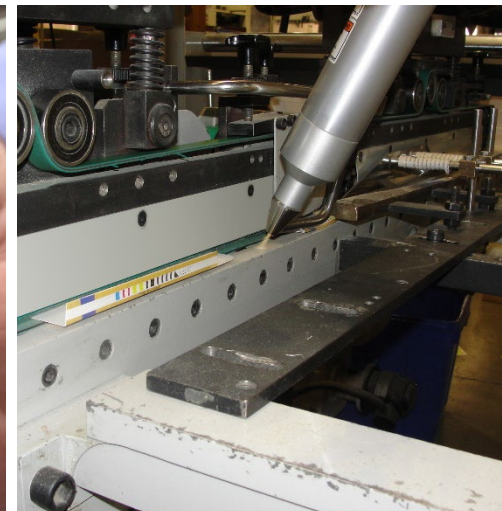




Improving Ink & Adhesive Bonding for Packaging Applications



Plasma & Flame Surface Treating Applications for Packaging

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**Yes, this webinar is
being recorded.**



**Have a Question?
Use the Question Tool Bar.**

A screenshot of a "Questions" tool bar. It has a title bar with a dropdown arrow and the word "Questions". Below the title bar is a text input field containing the question "Q: Is this webinar being recorded?". Below the input field is a "Send" button.

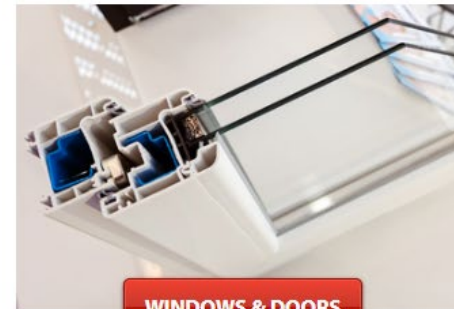
Overview

- Who uses plasma & flame surface treatment
- Why surface treatment may be needed
- What plasma does to a surface
- Applications
 - Direct Printing
 - Date & Lot Code Printing
 - Label Adhesion
 - Folding Carton
- Question/Answers



Industries & Applications

- Automotive
- Aerospace
- Window & Door
- Assembly
- Medical
- Electronics
- Decorating
- Packaging



Plasma & Flame Surface Treating Applications for Packaging

Industries & Applications

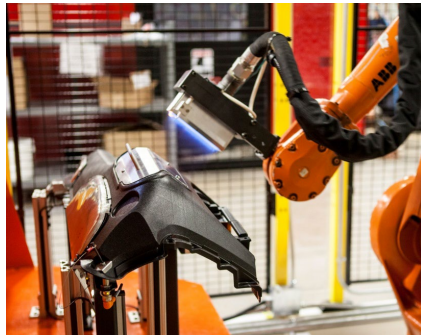
Printing



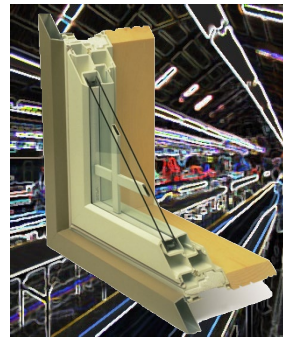
Labeling



Decorating



Assembly



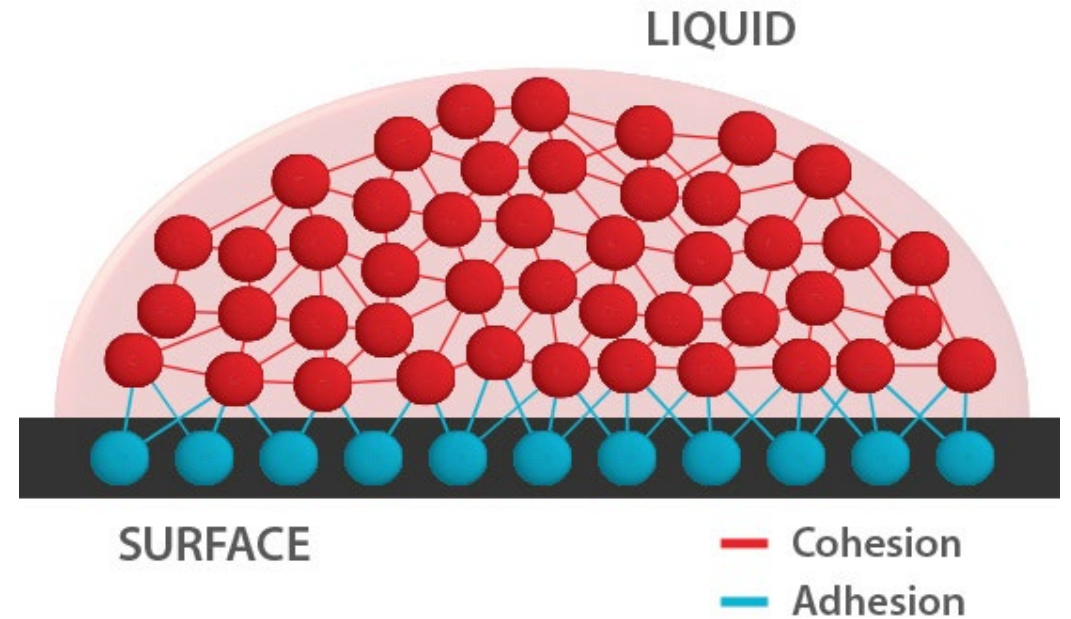
Potting



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Surface Preparation & Adhesion Dynamics

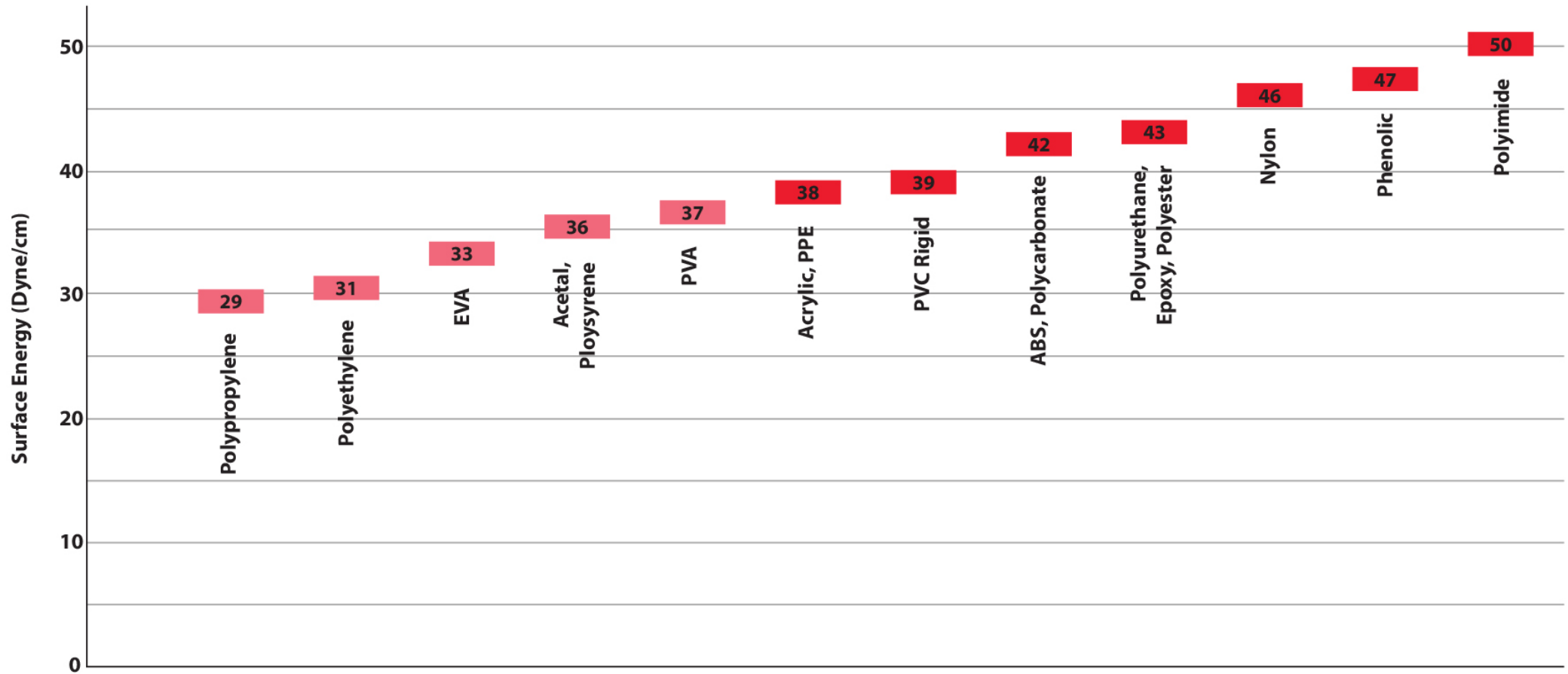
When you observe a liquid beading up on a surface, you are witnessing **the forces of cohesion** (the property of the liquid's like molecules to remain attracted) being stronger than the **forces of adhesion** (the property of unlike molecules to attract.)



Plasma & Flame Surface Treating Applications for Packaging

Typical Inherent Surface Energies

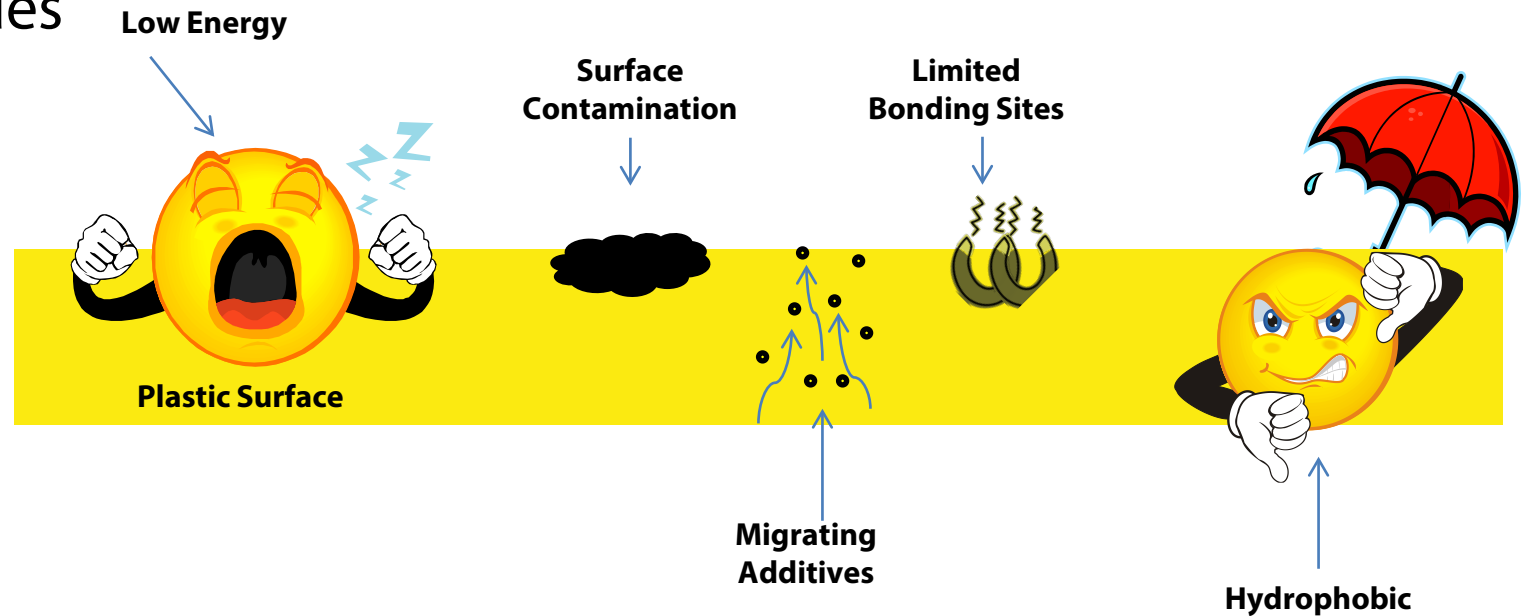
Prior to any treatment



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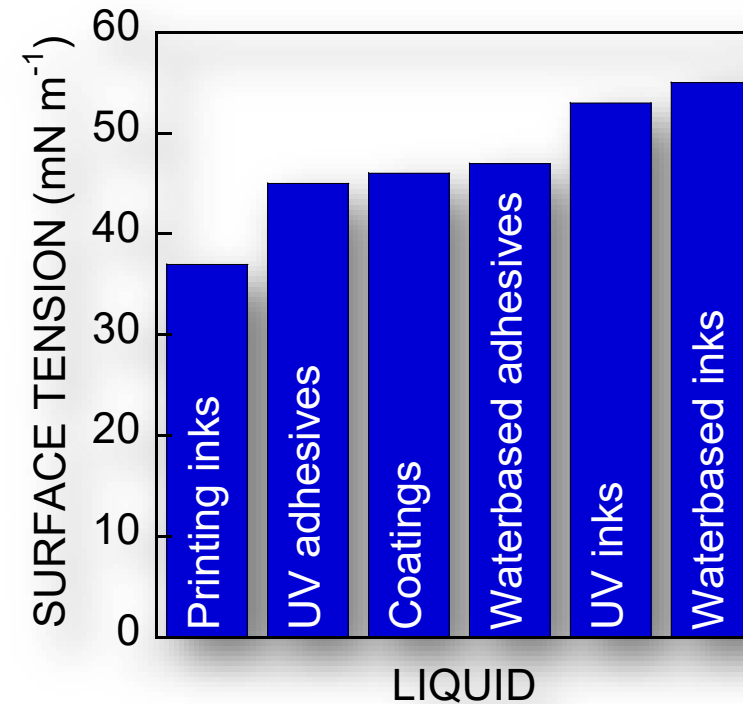
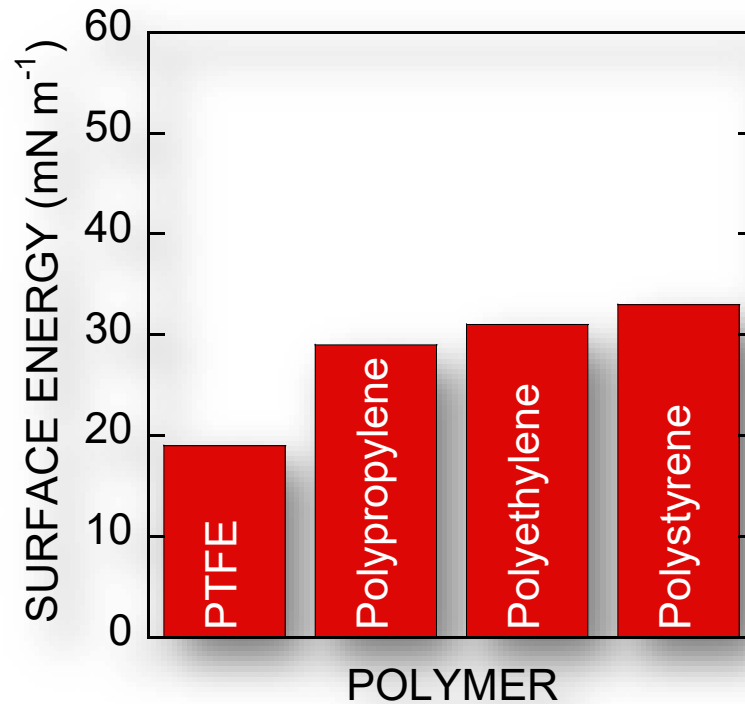
Adhesion Impediments

- Low Surface Tension
- Migration of Formulation Components
- Mold Release Agents
- Low temperature
- Design and Fabrication Issues
- UV light
- Mechanical Stresses



Higher Surface Energy Enables Adhesion

- Most polymers, having low surface energy, are hydrophobic.
- For good adhesion and wettability, the surface energy of the polymer should exceed the interface by $\approx 10 \text{ mN/m}$.



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Surface Treatment Results



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Surface Preparation Options

- **Liquid Primers**

Cost, hazardous, clean-up, consumable

- **Mechanical Preparations**

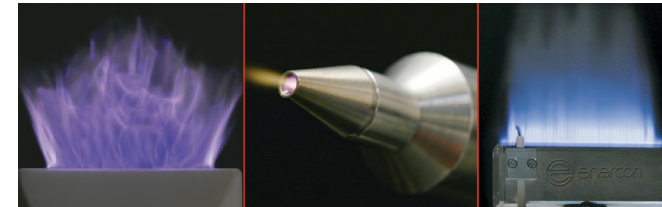
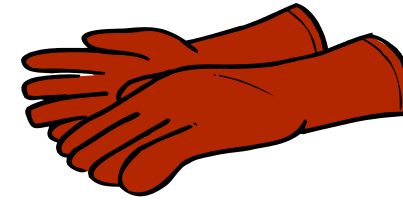
Cost, time, wear parts, clean-up

- **Vacuum Plasmas**

Capitol & consumable cost, time, batch process

- **Atmospheric Plasma & Flame**

In-line, continuous, economic



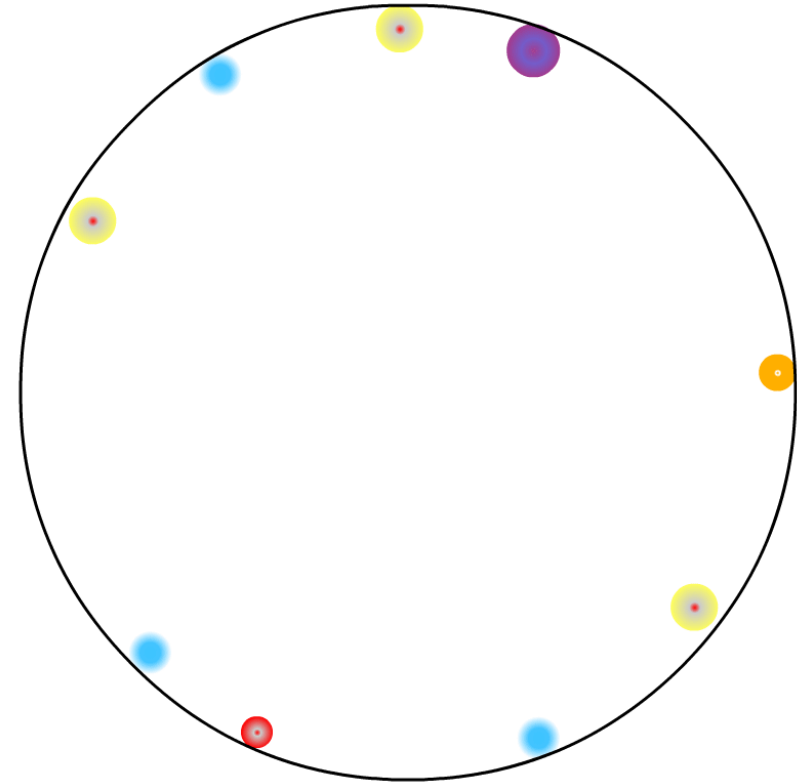
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What is Plasma

plasma : n ; “Fourth state of matter”, (Solid, Liquid, Gas, Plasma.)
Mixture of charged ions & energetic electrons generally in equilibrium.



-  Free Radical
-  Negative Ions
-  Ultraviolet Light Photon
-  Positive Ions
-  Electron



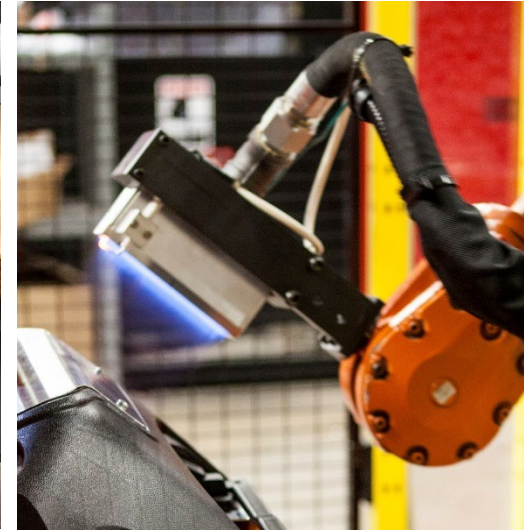
Plasma & Flame Treating Technologies



Blown-arc™



Blown-ion™



Flame Plasma



Blown-ion™ 500



Plasma & Flame Surface Treating Applications for Packaging

Each Design Features a Power Supply & Treatment Head(s)



Plasma & Flame Surface Treating Applications for Packaging

What does plasma treatment do?

CLEAN

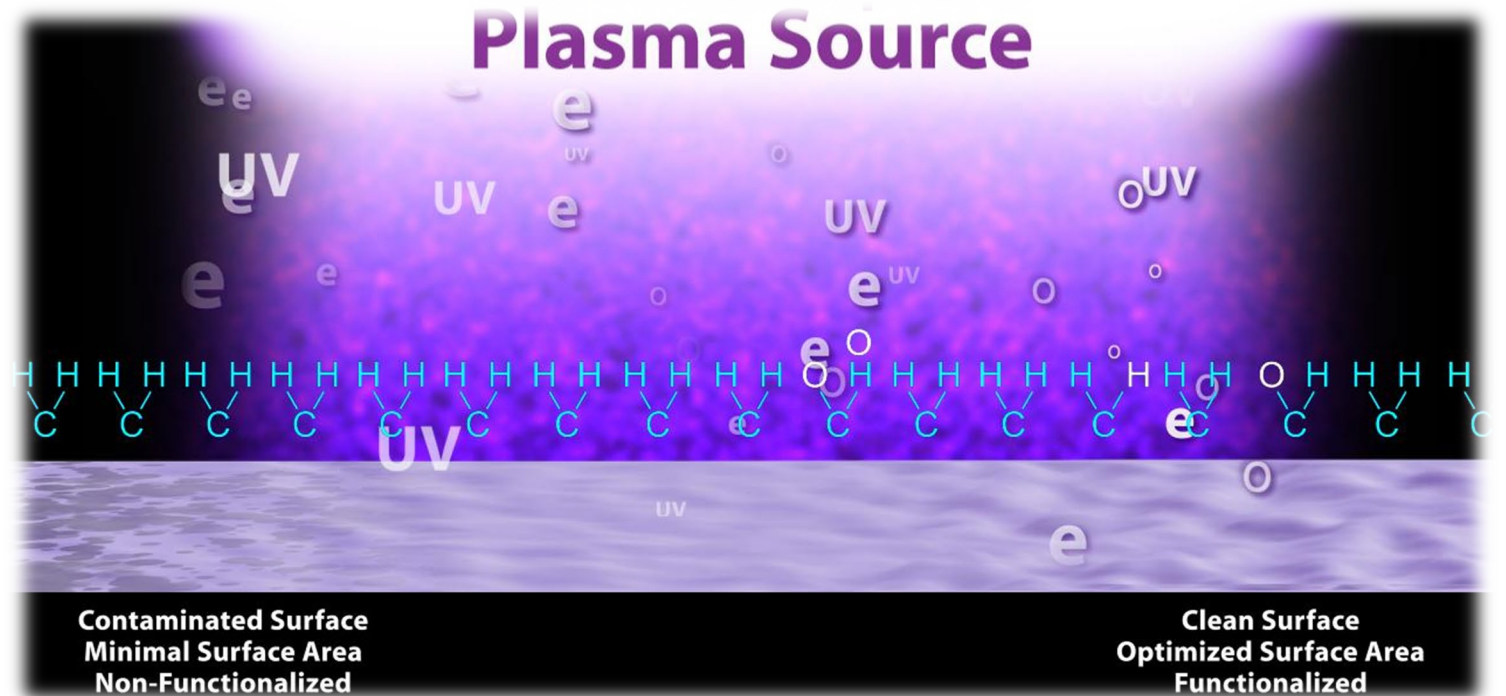
Plasma treatment removes organic and inorganic impurities & contaminants from the surface.

MICROETCH

Increases surface area creating more bonding sites, which promotes adhesion.

FUNCTIONALIZE

Increases polar groups, which directly contributes to the surface's adhesion properties.



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Lab Trial Results

	Untreated				Blown-ion				Flame			
	Dyne	Ca	Polarity	Sfe	Dyne	Ca	Polarity	Sfe	Dyne	Ca	Polarity	Sfe
PP	>30	94.35	1.55	29.62	58	47.83	20.6	57.6	70	38.59	9.5	44.64
PE	>30	114.9	0.28	28.69	60	45.28	21.41	59.9	56	52.22	16.94	56.34
PS	31	91.5	0.62	41.37	70	24.75	32.37	70.48	48	69.08	7.69	47.87
PA6	34	74.21	6.92	41.66	66	41.81	21.89	63.5	54	55.45	15.75	53.54
PA66	36	67.63	8.08	49.24	70	35.79	27.67	64.57	70	31.7	17.78	55.95
PET	>30	114.9	0.28	28.69	70	38.17	27.65	62.26	44	80.99	5.15	35.91



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Application Examples



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Date & Lot Code Printing Challenge

Best Formulations in California

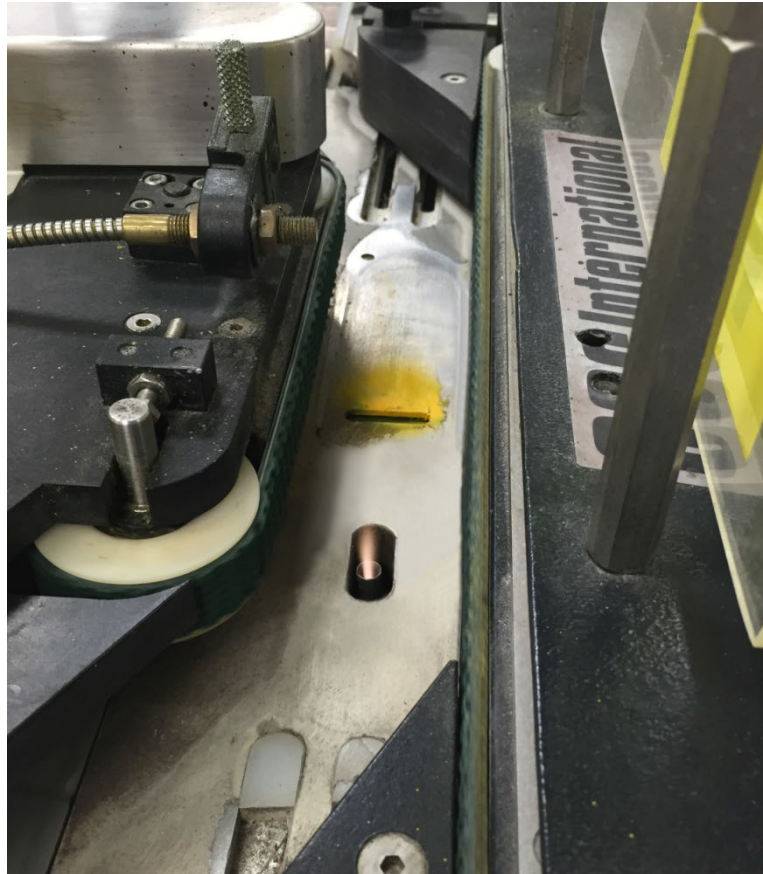
- Induction Cap Sealing Customer
- Poor Ink Adhesion on HDPE & PET Bottles
- Domino Inkjet Printer



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Integrating Plasma Treating

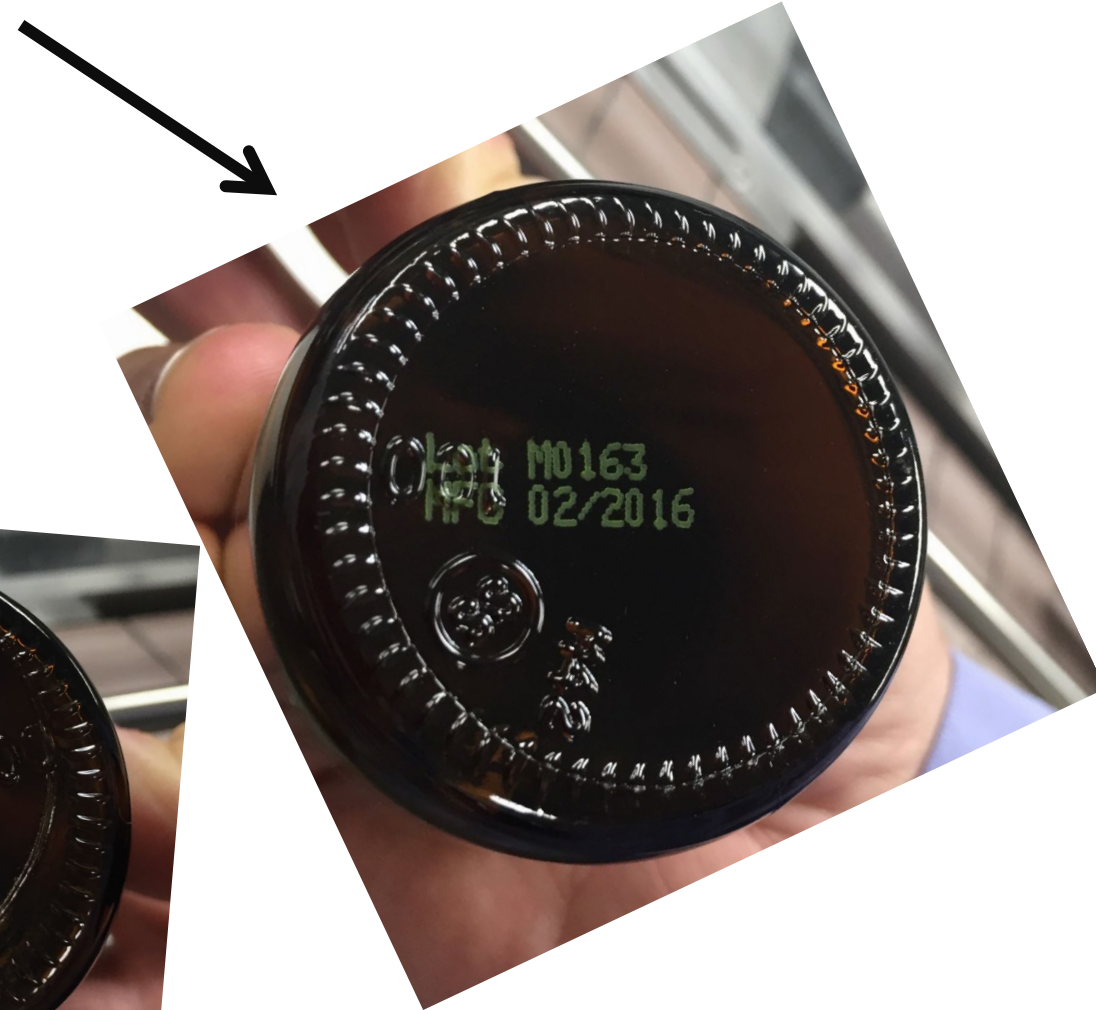
- Blown ion™ Plasma Treater
- integrated under the conveyor



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Print Quality With Plasma Treatment

- Vibrant, clear printing
- Added plasma to all of their lines

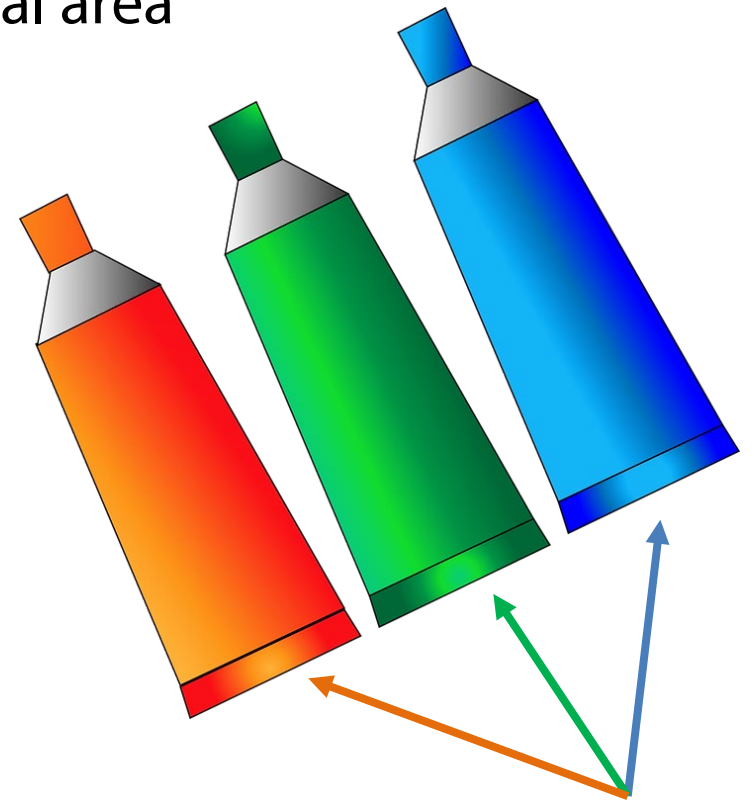


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Tube Printing Challenge

Promote UV Curable ink adhesion for Plastube in Canada

- Corona used to treat the body of the tube
- Corona creates backside treatment in the crimp/seal area
 - This can result in a poor seal & leaks



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Tube Printing Challenge

- Blown-ion plasma added to treat the outside of crimp/seal area

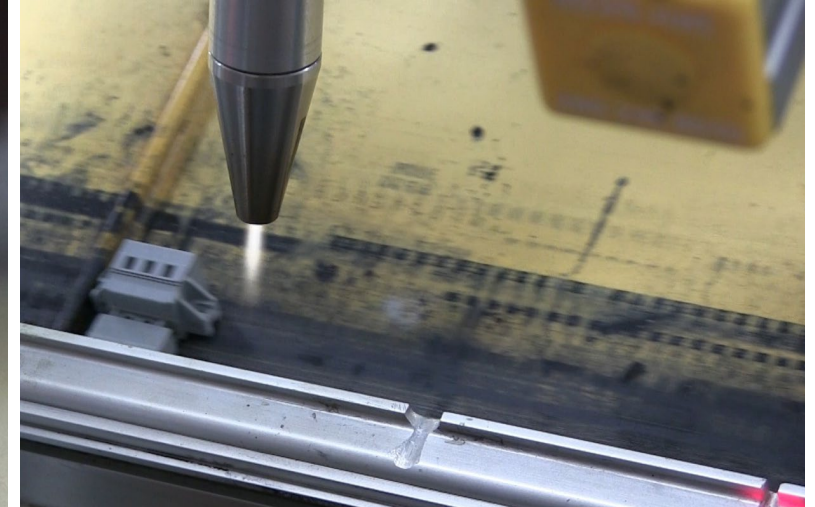
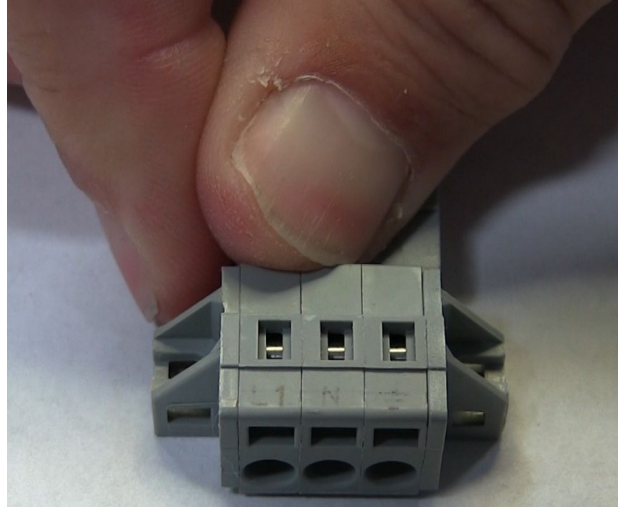


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Challenge: Inkjet Printing on Nylon 66 Terminal Blocks

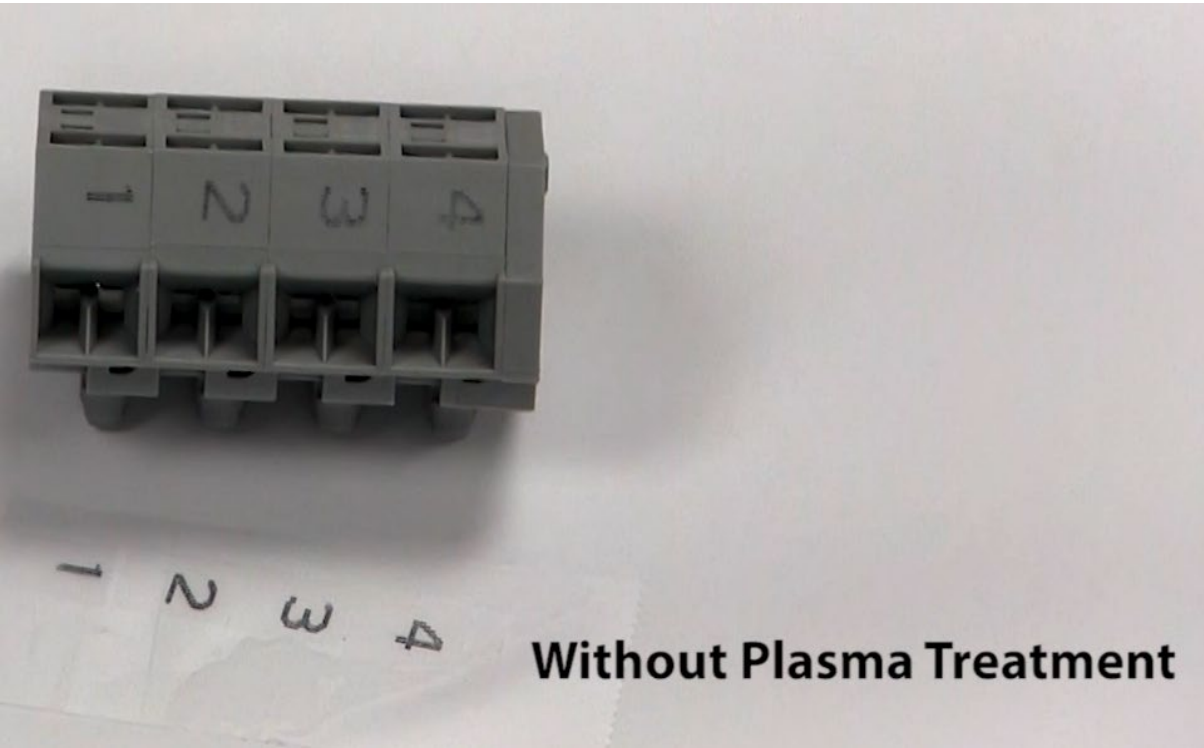
Promote ink adhesion for WAGO -Wisconsin

- Markem-Image Inkjet Printer on Nylon 66
- Used a manual liquid primer
- Replaced primer with automated solution
 - Blown-ion™ plasma treater



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Tape Test with and without Plasma Treatment



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Challenge: Label Adhesion

Promote label adhesion on bottles

- Larger surface area
 - Plasma
 - Blown-ion™ 500
 - Flame Treating



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Direct Printing Challenge

- Flame treated prior to printing
- Easy to treat larger areas very quickly
- Multidimensional surface
- Treat in a single pass



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Challenge: Folding Carton Adhesion

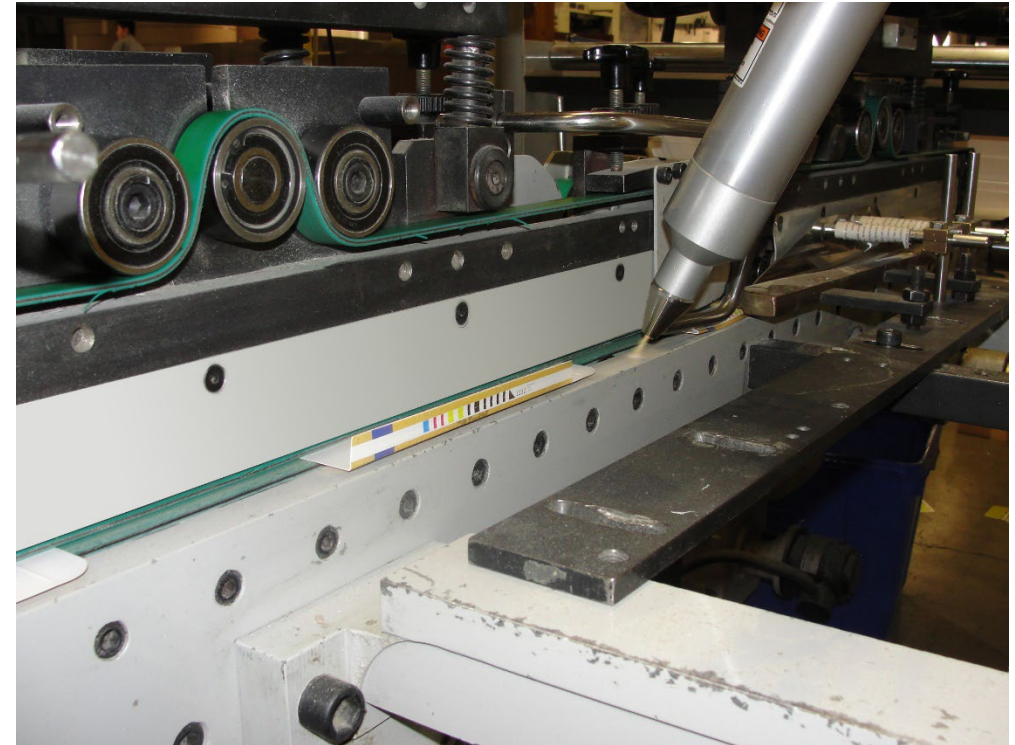
- Improve Operations Green Bay Packaging - Wisconsin
 - Stronger glue flap
 - Increase production speeds
 - Eliminate mechanical preparations, such as skiving
 - Ability to use cold set adhesives rather than hot-melt
 - cold set is generally less expensive and allows for quicker make readies



Challenge: Folding Carton Adhesion

Blown-ion™ Plasma Integrated in line

- Ideal for high speed lines
- Achieved all of the project goals



Plasma & Flame Surface Treating Applications for Packaging

Review

- Plasma & flame surface treating clean, etch and functionalize surfaces to improve ink & adhesive bonding
- Surface treating is effective on a wide range of materials
- In-line surface treating can eliminate other surface preparation methods
- Surface treating can improve quality, productivity & reduce costs



Questions?



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Thank you



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