Delta ENGINEERING

Plasma coating of plastic products

Improve your sustainability

WELCOME

Plasma coating is a well-known technology that we have now industrialised for the blow moulding industry.

Today, it is a stable and reliable technology improving the recyclability of plastics and generating dedicated material properties such as barrier improvement, migration, permeation, sliding properties to name a few.

After long testing and several market successes, we are now ready to deploy this technology into the market with our partners.

You will find more details in this dedicated brochure. Should you have an application in mind, please do not hesitate to get in touch with a member of our sales team.

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PLASMA ENHANCED CHEMICAL VAPOUR DEPOSITION

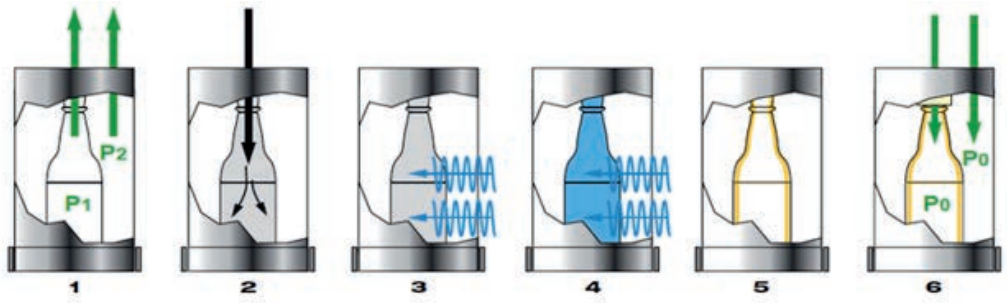
WHAT IS IT?

PECVD or plasma enhanced chemical vapour deposition, uses electrical discharge in low vacuum pressure condition to decompose a gas and create a thin coating layer on the inside wall of the product in the reactor. It is an environmentally friendly way to create fully recyclable coated products having different desired physical and/or chemical properties, depending on the material and the plasma gas used.

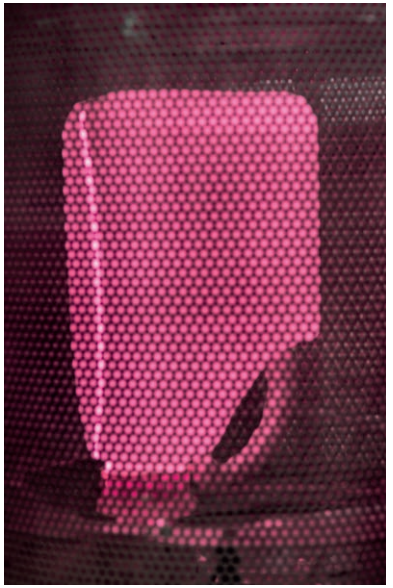
Different properties can be obtained:

- modification of the surface tension for better sliding, adhesion, wettability
- improvement of the barrier in different applications (migration, permeation, ...)

The products are inserted in a reactor. Both are vacuumised before the process starts. The following scheme shows the essence of our technology, when the bottle is placed inside the reactor.



The technology can be tuned, creating a tailor-made barrier.



Step 1a Vacuum in the reactor is created.
Step 1b Inside the product, we go deeper in vacuum up to the process pressure condition.
Step 2 A reactive gas - for example acetylene gas - is injected inside.
Step 3 Adding microwave power.
Step 4 The microwaves decompose the gas, creating very reactive 'free radicals'.
Step 4/5 These free radicals bind to the surface of the bottle, react and condensate to form a thin inert layer.
Step 6 Allowing atmospheric pressure to return into the reactor and the product.

PLASMA COATING

ENVIRONMENT

REPLACING NON-RECYCLABLE MULTILAYER PRODUCTS

Legislation is on its way requiring ambitious recycling of packaging material. That is challenging for multilayers: they provide good barrier properties, but can't be recycled because of the different layers, which can't be separated.

Our solution can create better barrier properties than multilayers, but it can be considered as a monolayer packaging.

EASY RECYCLABLE

It is easy to grind the coated material and recycle it, together with non-coated materials:

- The percentage of our coating is negligible to that of the plastic packaging: 60 to 150 nanometers.
- The coating will be largely removed during the washing process.
- Coated bottles won't reach a market penetration much higher than 10 %, which rules out a change in flake quality in the recycling plants.

USE OF ENVIRONMENTALLY FRIENDLY GASES

We only use environmentally friendly gases:

- Argon is an inert noble gas.
- The toxicity of acetylene is negligible and widely used in the welding industry.
- Using the new environmentally friendly HCF gases with a low GWP (Global Warming Potential) value and well-known in the world of refrigeration.

Furthermore, the gases are largely consumed during the process, reducing the exhaust to a minimum. The remainder can easily be captured with an active carbon filter, should local legislation require this.

USE ON BIODEGRADABLE MATERIAL

The coating technology can be applied on biodegradable materials as well.

PLASMA COATING

ADVANTAGES

WEIGHT REDUCTION

The coating provides very good barrier properties. In some cases, the wall thickness was increased to avoid switching to multilayer because of costs. Now, we can turn this around and reduce the wall thickness of the bottle in those cases, compensating by adding a Carbon or Carbon Fluor layer, depending on the application. Plasma coating can work together with foaming as well, reducing the weight even further, while maintaining the barrier & strenght.

USE OF SPECIAL GASES: TUNING THE BARRIER

By using different gases, we tune barrier properties: preventing migrations (with for example acetaldehyde) towards food, reducing or eliminating loss of active ingredients and interaction of the container with the product, etc.

BARRIER IMPROVEMENT

Our coating can be applied to PET:

- making bottles less susceptible to the ingress of oxygen (O2)
- making bottles less susceptible to the loss of carbon dioxide (CO2)
- improving the water vapour barrier
- avoiding migration of aldehydes and other chemicals

Our coating can be applied to HDPE:

- improving the oxygen barrier
- avoiding migration
- improving the solvent barrier

DIFFERENT PROCESSES

Also, we can tune the process to add properties such as improving sliding behaviour, avoiding plastic walls getting compromised (paneling) and reducing swelling of the polymer.

GOOD WITH FOOD

The coating:

- has no impact on the approval of materials suitable for food (EU regulation 10/2011)
- has no impact on the flavour of the contained foods (Robinson/EN1230-2)

PLASMA COATING

MACHINES

A complete range of machines for different speeds & markets is available.

For products from 50ml to 1000L IBCs.
Single reactor up to 16 reactor rotary machines.

PLASMA COATING

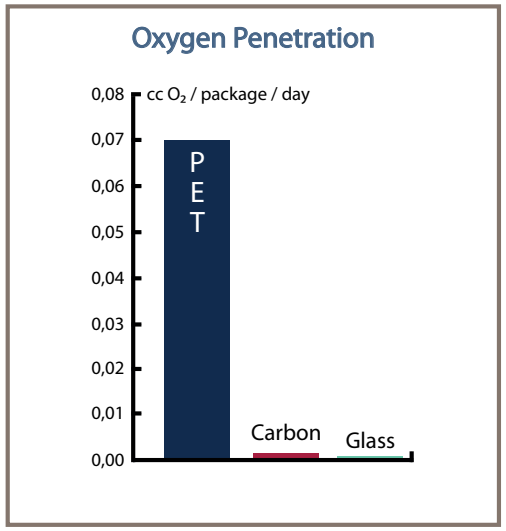
THE PET PROCESS

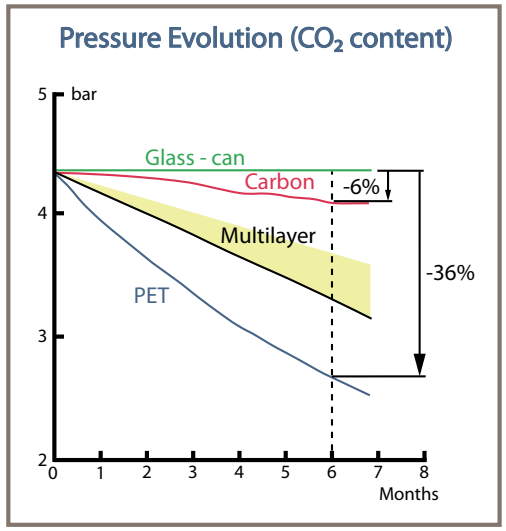
The PET process uses acetylene.

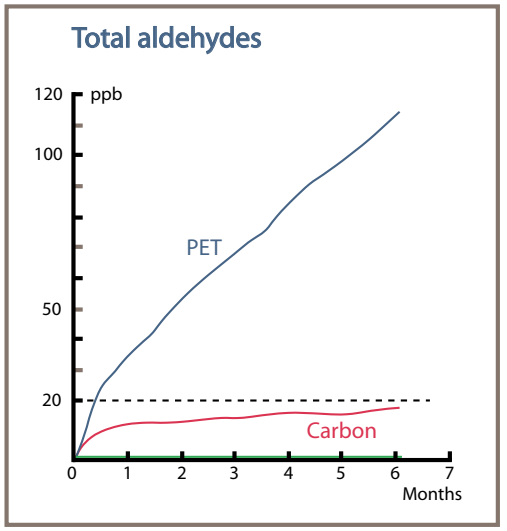
On PET, the coating:

- makes packaging 30 to 40 times less susceptible to the ingress of oxygen
- makes 6 to 7 times less susceptible to the loss of CO2
- improves the barrier against vapour 2 to 3 times
- reduces migration of aldehydes to food
- improves the barrier to absorption of chemicals out of the contained product
- increases the shelf life of products bottled in PET by a factor of up to 5

Our coating machine can be tuned for hot fill.







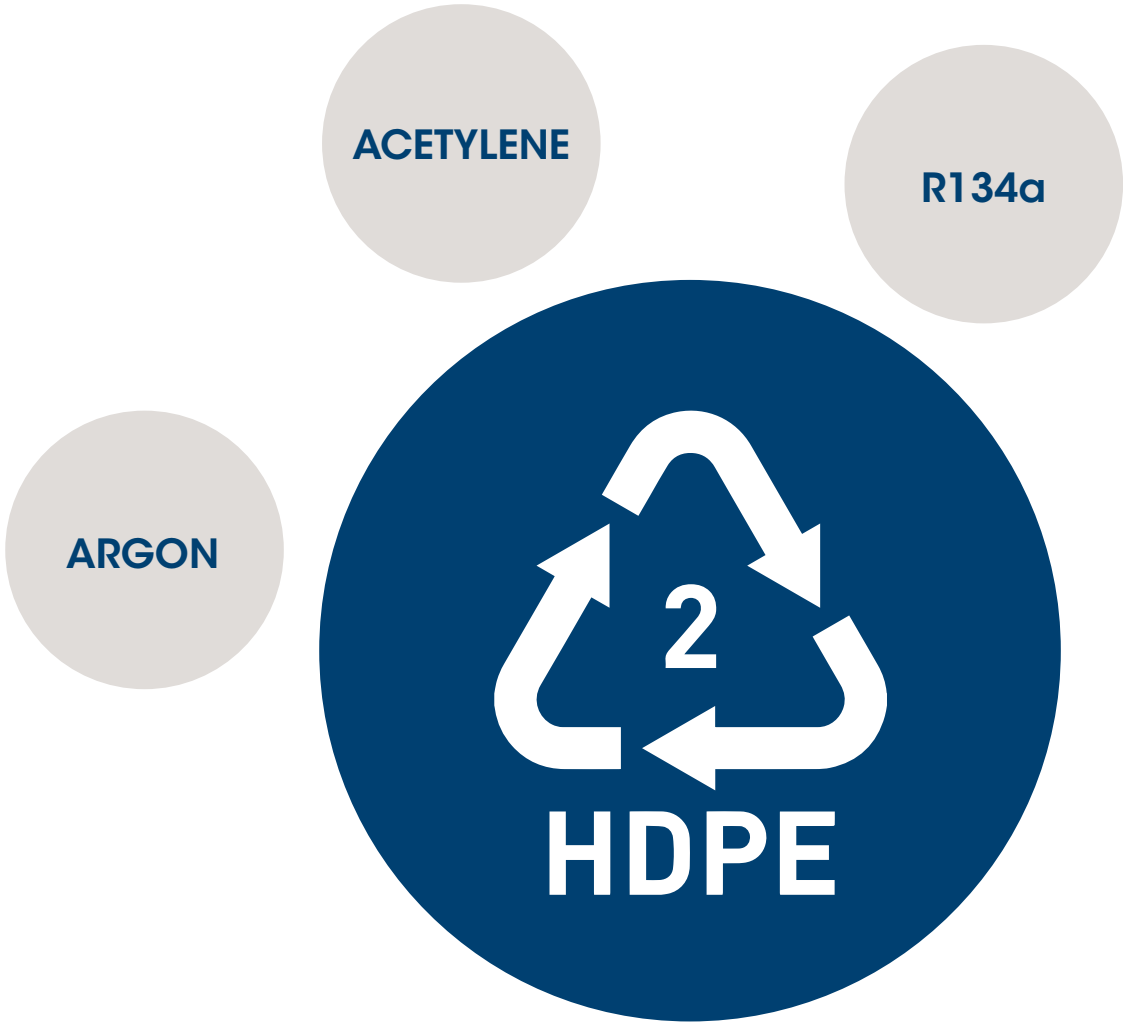
PLASMA COATING

THE HDPE PROCESS

The HDPE process implies the use of three gases: argon, acetylene and R134a*.

The coating reduces or eliminates:

- solvent permeation
- chemical attack
- loss of active ingredients
- interaction of the container with the product
- paneling
- container discoloration
- odor emission
- loss of flavour and fragrance
- absorption
- product adhesion (better cleaning)



* Or any other for the process selected HCF gas

PLASMA COATING

APPLICATIONS

Apart from being a green technology, the plasma coating technology has a very broad field of application:

REPLACING MULTILAYER PRODUCTS

A straightforward solution, the barrier level is generally in the same order or even better. The plasma coating makes the process on the blow moulding side much simpler than the multilayer technology. Multilayer products are more difficult to process, can have typical black spots (carbonated material), welding issues on the base (barrier leak), etc.
They also have more waste than monolayer products.

REPLACING METAL PACKAGING

This is especially an application for the Carbon Fluor process (solvent barrier) pails, tubes, cartridges, bottles, etc.

REPLACING FLUORINATION

Fluorination is a very dangerous and not environmentally friendly process which requires high capital investment. Getting the required permits can be challenging as well. Plasma coating is the environmental answer to this.

IMPROVED SHELF LIFE

This is a typical application for the PET process. The massive oxygen barrier improvment has a big positive impact on the shelf life. In food there are numerous applications: ketchup, sauces, vegetables, juices, etc. All applications where a good oxygen barrier is required.

PLASMA COATING

MARKETS

FOOD
Ketchup, mayonnaise, carbonated soft drinks, juices, flavours, …

COSMETIC
Hair care, mascara, shampoo, essential oils, …

CHEMICALS
Agrochemicals, paint, degreasers, cleaning products, fuels, insecticides, solvents, polish, waxes, …

PHARMA
Veterinary products, oxygen sensitive products, …

Solving todays recycling issues

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