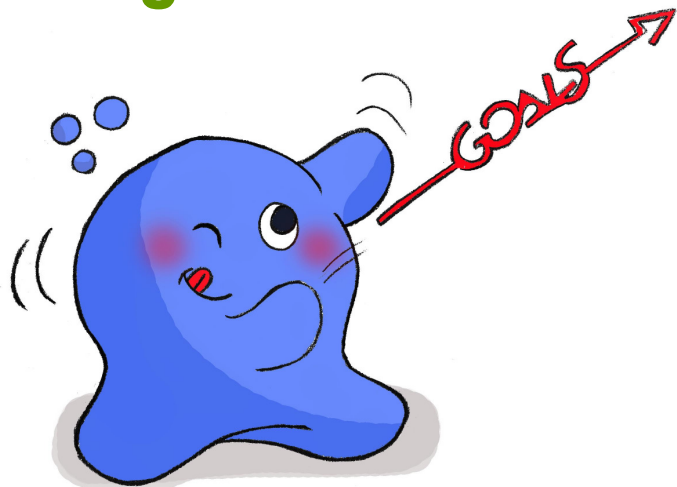


PlasmaNICE

The project results

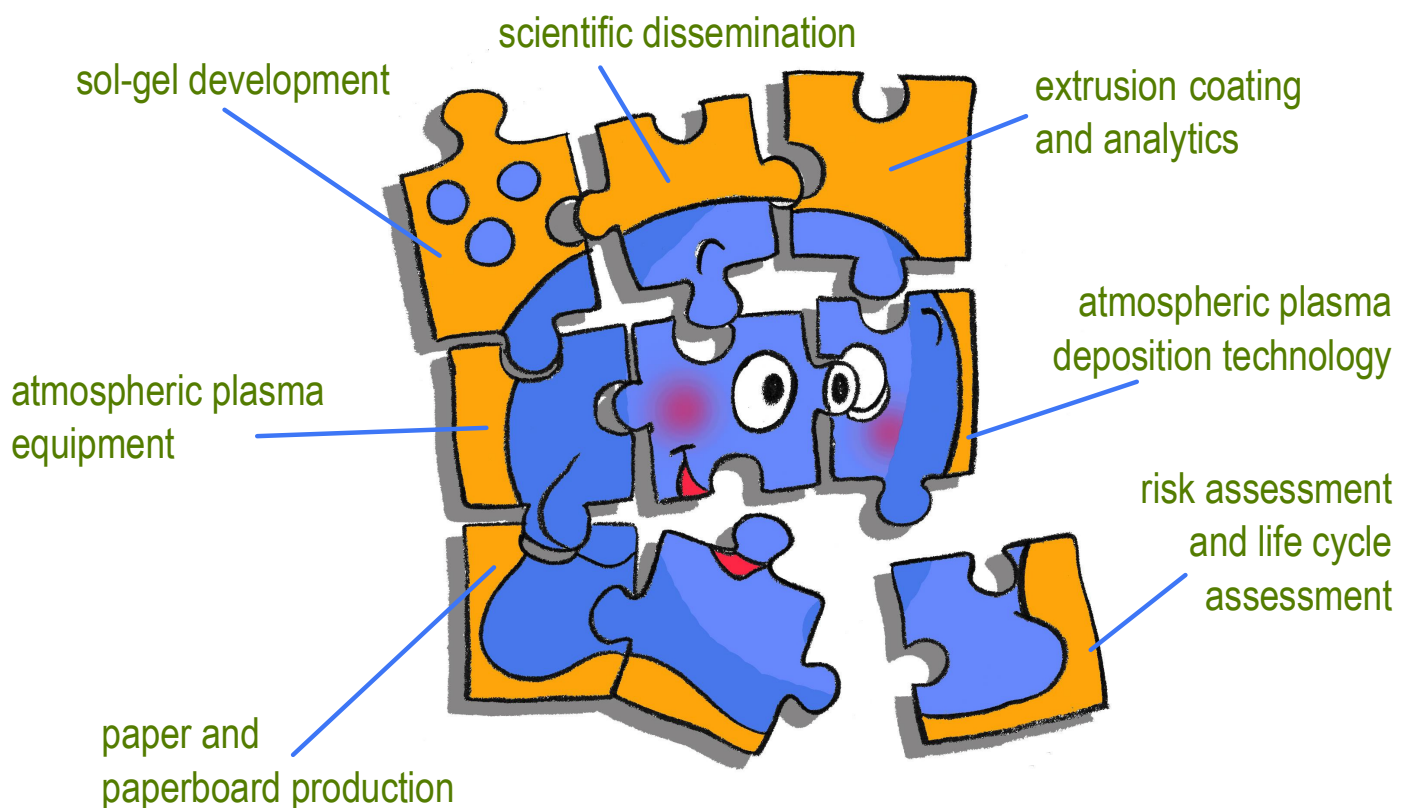
The goals



The main goal of PlasmaNice was to develop new machinery and processes for the creation of innovative packaging materials with improved performance, reduced environmental impact and improved recyclability. Most materials currently used for packaging are either derived from oil, a non-renewable resource, or are made of different materials, which can make recycling sometimes impossible, sometimes more complex than if only one material was used. The PlasmaNice project aimed at developing new, innovative coatings on different materials, such as plastic, cardboard and paper while at the same time guaranteeing safety in the workplace, for human health and the environment.

The skills

Each one of the consortium partners has strong specific skills and experience in one or more of the following domains; extrusion coating and analytics, atmospheric plasma deposition technology, sol-gel development, risk assessment and life cycle assessment, scientific dissemination, paper and paperboard production, atmospheric plasma equipment. Just like a puzzle, all the pieces fit neatly together to enable the team to work efficiently and effectively.



The results

Here are some examples of the results obtained during the PlasmaNice project.



PlasmaNice equipment

Atmospheric plasma techniques have the ability to tailor the surface chemistry at the nanometre level. They are also energy efficient, reproducible and environmentally clean. The wide scale application of this technology in the pre-treatment of packaging materials in reel-to-reel processing has, however, been severely limited due to the relatively slow processing velocity for coating depositions. The PlasmaNice project addressed in-line atmospheric plasma deposition of functional nanocoatings on various fiber-and polymer-based substrates from the laboratory scale to the industrial level in the packaging industry. For this reason great attention and energy were focused first on a lab scale plasma system, and then on a pilot scale plasma system.

Risk Assessment results

A specific risk assessment analysis of the process equipment was performed to find potential occupational health and safety problems concerning the processes used as well as the materials used with special regard to the nano-materials used. The potential risk of nanomaterial hazards for workers was estimated, distinguishing two phases of the production process: exposure to nano-silica in manufacturing and handling of nano-silica in the sol-gel solutions, and the exposure to nano-silica in the generation of nano-silica in atomizer and plasma processing. The evaluations for both production phases showed that measures should be put in place to control and reduce the exposure of employees to the nanomaterials. With appropriate measures the potential problem is expected to be fully controllable.

Regarding consumers, depending on the degradation of the coatings during use there could be a possibility of regenerating nanosized particles, but at this stage this is assumed to be a low likelihood as abrasion measurements do not provide indications that the dust contains nano-particles.



Hybrid grease barrier coatings

Another goal of the PlasmaNice project was to develop fluorine-free grease barrier coatings. Fluorinated coatings have been used for years with the purpose of making paper resistant to oil and grease, but there is now some concern about their potential health risks. It was the objective of the project to develop coatings based on inorganic-organic hybrid materials synthesized via sol-gel technology for reel-to-reel substrates (paper, paperboard and plastic films) which could be applied by plasma-deposition followed by UV curing. During the project, more than 50 different formulations were developed. For two selected compositions technical, commercial and LCA aspects such as commercial availability and cost, synthesis procedures, handling and storage and toxicity, were considered respectively. Tests showed that grease barrier properties were achieved comparable to that of fluorinated compounds.

To check environmental and health safety of the coatings containing nanoparticles, these were tested for possible nanoparticle release and also to make sure that fragments of the initiators would not migrate out of the coating. In both cases it was verified that there was no release or leaching.



The plasma cup

During the PlasmaNice project, case studies on different projects were conducted in order to test alternatives to traditional coatings. One such case study was about paper cups. Existing paper cups are made of cardboard coated with LDPE. LDPE stands for Low-density polyethylene and it is a plastic commonly used in packaging, such as plastic bags for example. The purpose of the case study was to substitute LDPE with PLA. PLA stands for Polylactic acid or polylactide (PLA), a polyester made with renewable resources. Paperboard and PLA need to adhere, and this is possible only when PLA is relatively thick. The target was to achieve a 50% weight reduction of PLA while maintaining its adhesive properties. The goal was successfully achieved.

