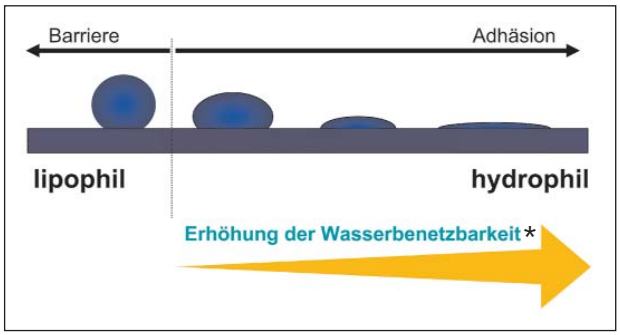
Your One-Stop Source for Fluorination Expertise - the Integrated Fluorination Process from Air Products

Efficient technical processes are a decisive factor in any company's success in the industry. Companies are always searching for ways to continue improving their production processes. As a result, process development has become a hot area within the industry. A modest investment in process development allows existing processes to be "tweaked" to optimize them over the long term, and new products and processes can be refined and further developed.



*Increasing of wettability

A water droplet demonstrates how fluorination works

As companies seek to optimize production processes, they are also focusing more attention on design innovations that will make their products stand out from the competition. Of course, companies pay even closer attention to the costs associated with possible innovations. This trend is particularly noticeable in material-coating processes, among others. Here's a concrete example: the haptics (feel) of the materials used in interior automotive trim have become an important way for car manufacturers to differentiate their products from their competitors' products, because the materials give the customer a feeling of driving something luxurious.

The flock industry has certainly profited from this trend because it was able to offer automobile manufacturers and automotive suppliers appropriate solutions. Likewise, automotive suppliers are no longer mere parts manufacturers-they have had to take on more and more development-related responsibility in an era of increasing cost pressure and shorter development cycles. Manufacturers and suppliers of technical components as well as companies in the packaging and furniture industries face similar challenges. These trends have made it increasingly important for all parties involved to be able to access comprehensive technical design and process expertise.

The fluorination of plastics is a good example. For companies in the flock industry, this process has become an attractive alternative to traditional processes for surface activation of plastics such as corona, primer, flame treatment, plasma, or chemical baths. Fluorination treatment is especially suitable for materials with complex shapes, as well as materials where traditional processes deliver unsatisfactory results.

Fluorine - the Gentle Surface Activation Treatment

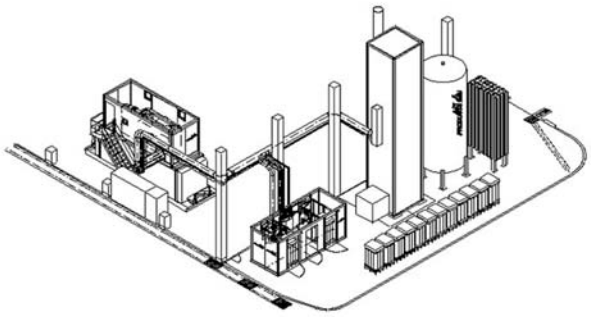
Traditional processes such as flame treatment and corona treatment damage the surface of the plastic to varying degrees. This is due to the high concentration of reactive species in the plasma flame and in the corona discharge zone. The extremely intense and aggressive oxidation of the plastic surface leads to the destruction of polymer chains. This makes the prepared surface layer mechanically unstable and too easy to remove. Thus, the effect of the surface activation treatment is soon lost.

From a technical standpoint, there are very few ways to influence the results of the process. While corona discharge is a particularly energy-rich treatment process to begin with, the activation effect produced by flame treatment depends not only on the distribution of active species in the flame, but also on the quality of the fuel gas.

Pre-treatment with atmospheric plasma (high-frequency or microwave flame treatment) is comparable to conventional flame treatment processes. However, unlike traditional flame oxidation ▷▷▷

processes, atmospheric plasma treatments also subject the plastic to short-wave UV radiation emitted by the plasma.

Low-pressure plasmas are also used for surface activation. Unlike flame treatment, corona discharge and HF or mid-wave flame treatment, low-pressure plasma treatment can also be used for plastic surface modification. The main drawback of the low-pressure plasma process is the low process pressure required, which takes a great deal of effort to realize from an apparatus standpoint. The low process pressure also means that only the outermost layer of the plastic is activated. Because the polymer chains in the plastic always exhibit a certain degree of mobility, the activation effect is often lost after only a short time.



OFFLINE fluorination system

Recently, there have also been attempts to prepare and subsequently modify plastic surfaces using UV radiation. In terms of its strength and durability, UV radiation suffers from the same limitations as low-pressure plasma. Because the UV radiation required to prepare the surface is fully absorbed by the surrounding air, the radiation area also has to be kept free of air using appropriate measures. Furthermore, the nature of the treatment means that areas of the workpiece that are in shadow are not treated.

However, in contrast to low-pressure plasma treatment, plastic preparation using UV light can be performed continuously.

Unlike any of these other methods, plastic surface preparation with fluorine can be performed under nearly any conditions, with nearly all materials. Because activation occurs via the relatively slow and non-aggressive reaction of fluorine with the plastics, and the reaction is further slowed by the presence of oxygen, fluorine activation can be easily and reliably controlled simply by adjusting the concentration of fluorine. Films can be pre-treated just as easily as surfaces with complex shapes. The substitution of hydrogen atoms during fluorination means that this process can also reach layers deeper down in the material, making the pre-treatment effect more permanent. The concentration of active species is very balanced and high enough to achieve a good activation effect, but not so high that it damages the surface. The effects of fluorination described here for the surface activation of plastics can also be achieved with all other polymer products.

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Implementing this alternative technology, or using the process for a wider range of operations, can be a very time-consuming and expensive process. As one of the leading providers of process and engineering services relating specifically to fluorination technology, Air Products has bundled its areas of competence into an innovative service palette called the Integrated Fluorination Process (IFP).

Air Products experts work together with you, our customers, to develop and optimize the right fluorination processes for your product or process concepts. The result is a process design package that serves as a road map for basic engineering as well as an estimate of the associated investment and manufacturing costs.

Before we build the complete system, we can manufacture sample products using a test system. The IFP also includes the feasibility analysis, chemical and mechanical process engineering services, and system construction from a single provider, as well as industrial safety and environmental protection engineering and project management.

Air Products can assemble an interdisciplinary IFP team tailored to your specific requirements, allowing experts from different disciplines to put their collective knowledge, experience, and expertise to work for you. We make these resources available to you without any additional fixed costs, and they're just a phone call away.

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