The demands to surfaces of commodities are getting more and more sophisticated. Optical and haptic appealing designs reached by lacquering are in the focus as well as environmentally aspects. Polymeric materials known as easy to process and ideal to design often hit to limits due to their bad adhesion and wettability.

Fluorination is the key to solve these problems permanently. In only one process step the surface tension is increased without any mechanical load. Hereby hydrogen atoms from the backbone of the polymer chains are partially substituted by fluorine atoms.

This leads to excellent surface properties like:
- increase of adhesion of lacquers, paints and adhesives
- decrease of permeation of gases and liquids
- enhancement of tribological properties

In contrast to other surface pretreatments (e.g. flame treatment, corona treatment or treatment in low-pressure plasma), fluorination leads to durable surface properties irrespective of the components structure.

Fluorinated PE samples show significantly increased lap shear strength compared to untreated tension bars glued together with an epoxy resin.

The excellent ageing behaviour of fluorinated plastic surfaces is mainly caused by the relatively high penetration depth of some micrometers. So even after molecule movements (e.g. caused by temperature changes) the pretreatment is unaltered. The same molecule thick surface layer has advantages towards other kinds of pretreatment especially if the articles were exposed to a high loading before the refinement.
Polymers are characterised by outstanding properties like easy processability, low weight and excellent chemical resistance. Fluorination offers the effective possibility to increase the range of application.

The high reactivity of fluorine leads to a partially substitution of hydrogen with fluorine on the surface of the polymer. The fluorine modified surface layer shows high binding energies and is very resistant towards ageing.

Fluorination leads to a permanent modification of polymer surfaces. These surfaces show excellent adhesion, significantly decreased permeation and optimised tribological properties.

DECREASED PERMEATION

By reducing the permeability of gases and liquids through plastics by fluorination, both economical and environmental aspects can be connected. On the one hand the loss of volume and the change of bulk properties can be avoided and harmful odours can be reduced. On the other hand the usage of cost efficient, lightweight and environmentally friendly packing materials are possible.

Fluorination can reduce the permeation of liquids (here toluol) and gases through polymeric parts often by decimal power.
ADVANTAGES

Fluorination is a well-known pretreatment method to modify polymer surfaces. Compared to other pretreatment methods (e.g. flame treatment, corona treatment or treatment in low-pressure plasma) fluorination has the following essential advantages:

- The penetration depth of fluorine is relatively high leading to a permanent stable surface layer. The high mobility of fluorine atoms lead to a uniform surface treatment all over the threedimensional parts.
- The surface is neither exposed to mechanical nor thermal load. The properties of the bulk material remain unchanged, only the surface layer is modified.
- Under environmental aspect fluorination is rated to be absolutely harmless.

SAFETY DUE TO ENHANCED SURFACE ENERGY

Improved surface properties by fluorination create safety in the subsequent processing of the parts to refine. For the lacquering of fluorinated parts a primer or a base coat is not necessary, as fluorinated surfaces show optimised adhesion properties. The attainable improvement of surface energy depends on fluorination time, temperature and the concentration of fluorine. The selection of these parameters is the basis of MAINCOR’s competence.

<table>
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<tr>
<th>Material</th>
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</table>

SAFETY DUE TO ENHANCED SURFACE ENERGY

RESEARCH AND DEVELOPMENT

To make use of the immense possibilities of fluorination MAINCOR has started a project with universities to explore basically theoretical and application technology properties of gas phase fluorination.

Mainly the behaviour of the surface as function of fluorination parameters as well as the ageing behaviour which should be correlated with adhesive bonding are in the focus.

The effect of fluorination for new parts is tested in long term tests. The results of these studies give customers the safety of acquiring a reliable service for his products.