

Use of in-line plasma pre-treatment in sandwich moulding

Improved composite adhesion

Injection moulding technology

For in-line plasma pre-treatment in sandwich injection moulding there is a production cell in NMF's pilot plant which includes a bending arm robot from Krauss-Maffei and a plasma source from Plasmatreat.

Photos: Krauss-Maffei



What is known as in-line plasma pre-treatment has far-reaching potential for improving bonding properties in sandwich moulding. A trial facility to check this out has been set up in the pilot plant of Neue Materialien Fürth (NMF) GmbH.

The plant in the NMF Competence Centre comprises a KM125-390-160CZ two-component production cell with plasma feed through a hexaxial bending arm robot which was supplied by Krauss-Maffei in cooperation with Plasmatreat.

The focus of activity is to improve composite adhesion between two components by means of short-duration plasma pre-treatment under ambient conditions directly in the injection moulding process. Fundamental knowledge and analysis in the field of sandwich technology is being brought into the project through a cooperative partnership with the Chair of Plastics Technology of the University of Erlangen-Nürnberg.

In detail

Improvement in adhesion is achieved using the patented Openair method of Plasmatreat GmbH, Steinhagen. During the opening phase of the injection mould the bending arm robot moves the pistol-shaped plasma jet up to the injection moulded part and carries out a selective pre-treatment of the contact surface under normal atmospheric conditions. In doing so the plasma beam can be adjusted to pinpoint accuracy. By using a compact and hence mobile plasma source the latter can be integrated directly into the production workflow (in-line process). Furthermore, with this approach local action on parts having complex geometry is possible as well as the partial treatment of large-area components.

The short action time of the plasma stream allows mild and effective pre-treatment. Due to the action of the plasma beam organic impurities are removed (secondary cleaning), reactive or active groups are incorporated into the surface of the material (activation) and surface layers inhibiting adhesion are broken up (oxide layers).

This pre-treatment affords the following potential improvements in sandwich technology.

- Achievement of integral composites for combinations of materials which hitherto adhered only moderately or not at all and thereby extending the compatibility matrix.
- Increase in the achievable level of adhesion and the possibility of joining standard materials.
- Reduction of the impact of processing parameters influencing adhesion so that processing can be carried out at low temperatures and pressures.



When the mould is opened a bending arm robot moves the plasma jet up to the contact surface of the injection moulded part.

Even in encapsulation and back injection

In order to adapt the action of the plasma to the geometry of the component and to the material the geometries of the jets and their travel movements are varied appropriately. Accordingly, the field of application of the process is not restricted only to the pre-treatment of a moulding at an early stage in the two-component process, but also allows improved adhesion in the encapsulation or back injection of metals and films.

In order to investigate the potential of this new process technology systematically in a manner related to applications and for the most varied combinations of materials the industry working group "Two-component injection moulding with in-line plasma pre-treatment" was formed. This remains open for further companies to join. Interested parties should contact Simon



Amesöder, member of staff responsible for in-line plasma technology at the Chair of Plastics Technology (University of Erlangen-Nürnberg). Furthermore, as part of a series of industry projects, injection moulding trials on certain mated pairs of materials are possible.

In-line plasma pre-treatment improves the composite adhesion of two materials which can be measured via what is referred to as their peel resistance.

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