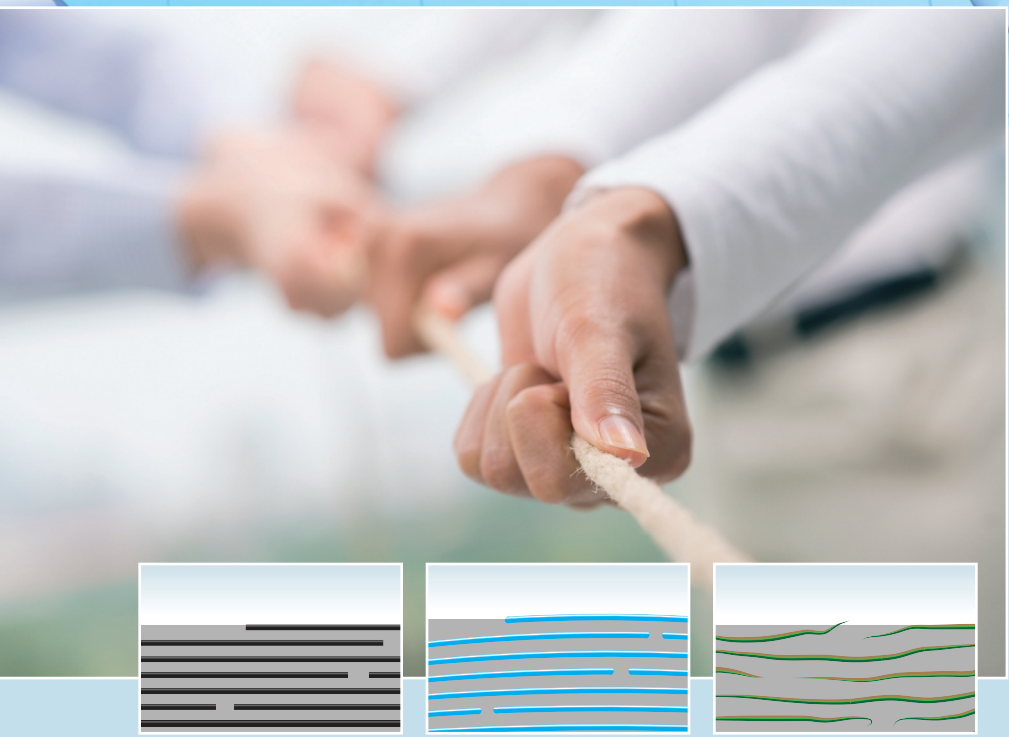
Fluor Technik System GmbH

Gentle activation for enhanced fibre adhesion

Fibre reinforcement for composites

➜ for temperature-sensitive fibres ➜ unchanged properties ➜ reliable process



Objective

To ensure sufficient wetting and adhesion properties, fibre materials and textile reinforcements often need to be surface-treated before being embedded in matrix systems such as thermosetting plastics, thermoplastic resins, concrete and ceramics. Common processes include high thermal, energetic or chemical stress, frequently affecting fibre structure and mechanical properties (tension/expansion). Also, shadowing within the tex-tile geometry often leads to uneven surface functionalisation. Both effects may cause significant quality issues in fibre-reinforced components.

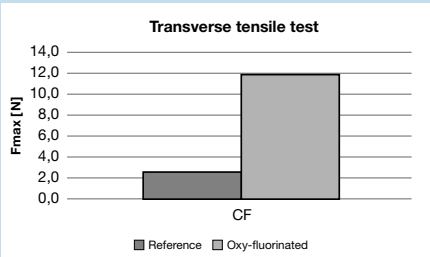
Solution

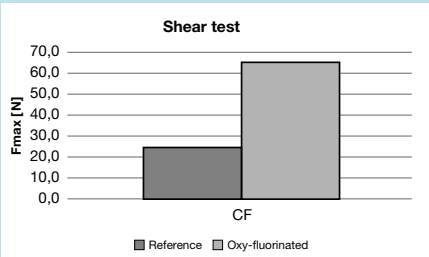
Gas-phase fluorination with exposure to atmospheric oxygen allows the surface function-alisation of fibre materials (single fibres, filaments, surfaces and three-dimensional struc-tures). This leads to a significant increase of the reciprocal properties (wetting, adhesion) at room temperature, gentle energetic conditions and, due to the treatment on molecular level (≤ 0.5 nm), an absolutely homogeneous coating of the fibre surface. After gas-phase fluorination, textile structures can create very strong adhesive bonding forces with the most diverse matrix materials to form fibre-reinforced composites of very high load carrying capacity. When not yet embedded, structures can be stored for ex-tended periods while maintaining their full functionality.

Critical effects for fibre materials	Fluorination process for fibre
Thermal, energetic or chemical effects on the basic structures of fibre polymers	No manipulation of the fibre-forming macro-molecular basic structures during the following surface functional-isation
Inhomogeneous property profile of treated fibre surfaces	Absolutely even treatment across the entire surface to create wettable and adhesive functionalities without shadowing-related defects
Fibre matrix adhesion problems, negative pull-out behaviour	High level of adhesion for various fibrematrix combina-tions
Loss of maximum tensile load and stiffness (e-modulus)	All physical properties of the textile material such as tensile force and stiffness are preserved
Profitability for fibre materials and their treatment	Economically optimised selection of fibre materials due to simple treatment options
Tight processing frames for the activation of textile materials	Reliable, reproducible treatment processes

Materials

- Short, long, staple fibres as well as continuous filaments and derived textile structures
- Carbon fibres
- Ultra-high molecular weight polyethylene (UHMW-PE)
- High-performance polyester
- Polyester made of renewable resources (PLA, PHB)
- Polyphenylene sulphide (PPS)
- Polyetheretherketone (PEEK)





Textile-physical tests of the bonding of carbon fibre material in untreated and fluori-nated state[1]

[1]Iris Käppler, Paul Matthäi, Chokri Cherif, Adhesion Problematic for Novel Non-Crimp Fabric and Surface Modification of Carbon-Fibres Using Oxy-Fluorination, World Academy of Science, Engineering and Technology, International Journal of Chemical, Nuclear, Metallurgical and Materials Engineering Vol:8 No:12, 2014

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FTS Fluor Technik System GmbH

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FTS has focussed on the development and manufacture of fluorination systems and fluorination services for more than 20 years. Realised projects, memberships in trade associations, cooperation with universities and research institutes, as well as many patents, are proof of FTS' expertise. We are member of the Flock Association of Europe FAoE e.V.

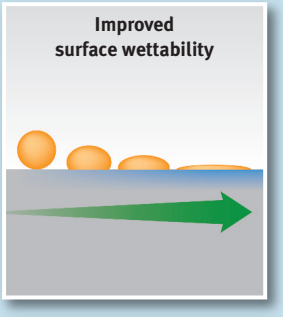
Consulting
FTS advises on actions, potential applications and effects of gas-phase fluorination of plastics and other materials. For optimal results, FTS tests the treatment parameters in its own laboratory in close cooperation with its customers.

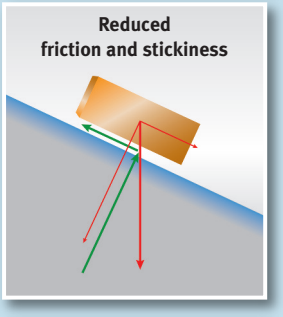
Development and engineering
FTS develops and designs systems that are customised to our customers' individual requirements. We utilise our extensive experience in plant engineering and operation – from planning and engineering to installation and commissioning.

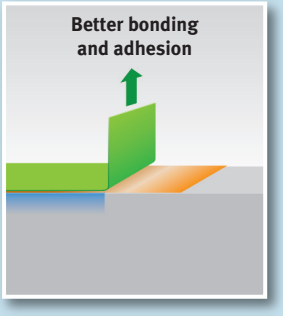
Plant engineering
FTS builds inline and offline systems for gas-phase fluorination, adjusting them specifically to the requirements defined by the product or operation. Ancillary systems such as fluorine supply, calcium carbonate absorber and work safety devices are included in the equipment design.

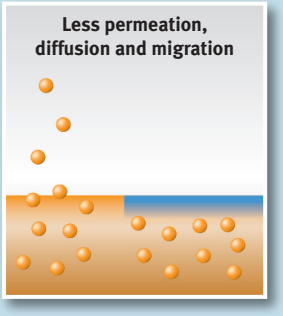
Service
FTS offers a full range of services: from operator training and routine maintenance to system extension and conversion. We support the approval and certification of the systems.

Job order production
FTS refines the surfaces of supplied products for further processing and installation: bulk material, products placed in transport units, web material, etc.









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