

Connection technology

for CFRP materials



Welcome to baier & michels



Group headquarters in an idyllic location
in Ober-Ramstadt near Frankfurt.

Dear customer,
dear business partner,

the globally oriented b&m group has built up a strong position as a partner for connection technology and C-parts management in the automotive industry. This is based on innovations in products, processes and systems, and confidence through competence, commitment and soundness.

In the field of technology new innovative products are being developed as problem solvers for customers. Our application engineers support customers with their requirements. A unique standardization tool with an online portal can massively reduce the variety of parts the customer uses.

As a producer, the b&m Group has the know-how to ensure very high and reliable product quality. With b&m Logistics, the b&m Group has a company that optimizes the customers' supply chain worldwide through modern systems such as RFID.

I wish you stimulating reading

Peter Federolf
Managing Director

baier & michels, founded in 1932, has developed a strong position as a supplier of joining technology in the automotive industry and now employs more than 400 people worldwide. The Würth Group, to which b & m has belonged since 1973, provides additional financial stability with more than 74,500 employees and over 12,7 billion Euro in sales worldwide. baier & michels is now active in Europe, Asia and North America.



Connection technology for CFRP materials

WHY USE A DIRECT SCREWING CONNECTION

The direct screwing connection of carbon fiber components offer a considerable economic advantages over other joining techniques due to the connections ability to disconnect.

Usually, non-releasable joining techniques such as gluing and welding are used when joining fiber composite components. Alternative force introduction elements, such as, e.g. bonded bolts, permit a non-

permanent connection, but these have many disadvantages. For example, the setting of an adhesive joint, the curing time of the adhesive as well as the installation space and the application of the bolts is associated with considerable time and effort.

In the case of the direct screwing connection, the fasteners (screws) produce a thread when screwing in. The thread produced results from the forming process when screwing into the polymer material. This system has the advantage of avoiding self-tapping. Thus, it is fast, efficient, reproducible and cost-effective.

Tailored solution for a direct screwing connection in CFRP

The realization of direct screwing connections in fiber composite materials (CFRP/GRP) is often avoided due to very thin wall thicknesses and the delamination effects of designers.

In addition, corrosion reactions often occur when CFRP fibers came in contact with metallic fasteners, which can severely affect the connection in its function.

For this application, baier & michels has developed a connection system that allows a direct screwing connection in CFRP.

The b&m carbon fiber system solution



b&m-CARBONPLAST®

+



b&m-CARBONCONNECT®

The integrative screwing system for continuous-fiber reinforced composites consists of a corrosion-resistant screw and an optional component-integrated tube:

- **also for thin wall thicknesses**
- **free of delaminations**
- **corrosion resistant**
- **with high connection strength**

Project example

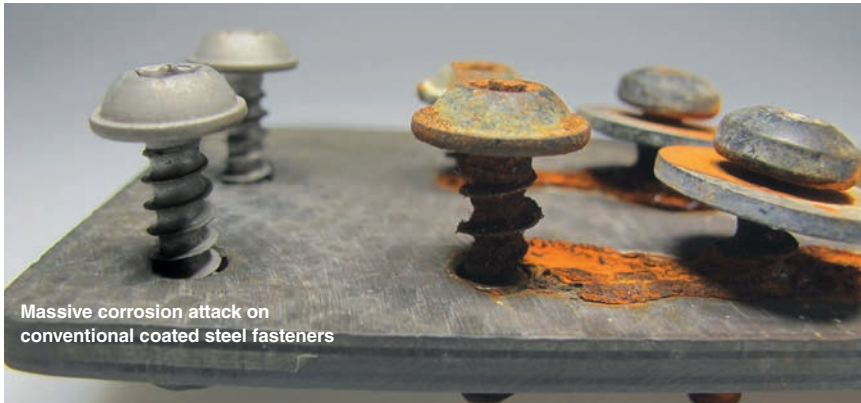
Attachment of a titanium mesh to a carbon fiber reinforced cover in the rear area of a sports car



Innovation in CFRP connection technology

Due to the innovative properties of the b&m-CARBON products the typical challenges faced by designers during direct screwing in CFRP materials is a thing of the past:

Corrosion-resistant fasteners



CHALLENGE:

Massive corrosion attack on conventional coated steel fasteners

When using commercially available screws in CFRP materials a violent corrosion reaction occurs after a short time. This is due to their very different electrochemical potentials. Even stainless steel screws (A2/A4) are attacked by this reaction. Fasteners made from “higher-grade”

materials, such as titanium, are often the only solution. These, however, have another disadvantage, in addition to an extremely high price (factor 100 compared to steel). Due to a comparatively low strength against steel, a larger dimensioning is required. Also, screws of this material are not suitable for direct screwing into CFRP components since the thread tips do not have sufficient strength.

SOLUTION:

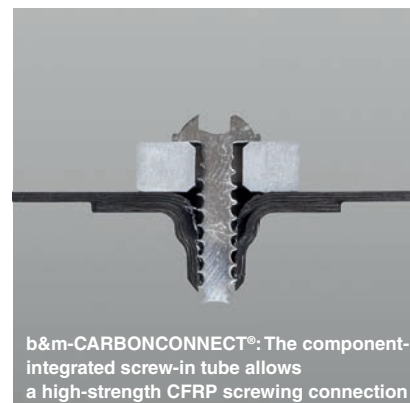
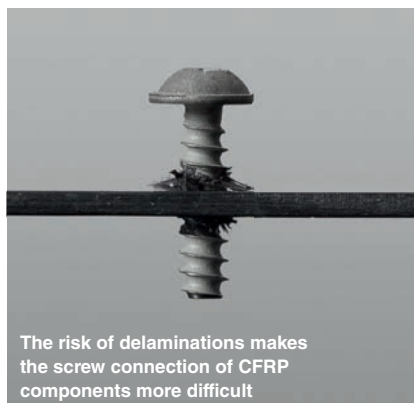
Corrosion-resistant screw b&m-CARBONPLAST®

- Corrosion-resistant austenitic material
- Suited for cutting threads in CFRP materials
- Resistant to abrasive wear through carbon fibers
- Material flow optimized thread geometry
- Coloring also possible in black

...also available as metric screw, **b&m-CARBONMETRIC®**.



Robust screw connection



CHALLENGE:

Material-dependent low screw-in depths as well as the risk of delamination make the screw connection of CFRP components difficult

Plastic direct screw connections in fiber composite structures are often not achievable due to the low screw-in depth ($<0.5x_d$). If these are nevertheless necessary, often only an undesirable material thickening help or the cost-intensive use of inserts or big

heads, head bolts of titanium or similar materials help, which are laminated or glued on.

Cost-effective direct screwing connections, in which the thread of the screw itself forms in the material of the component, but are not limited by the lower wall thickness. The thread turns which penetrate parallel to the fiber course lead to high transverse forces within the material and thus produce delaminations of fiber and matrix.

SOLUTION:

Component-integrated screw-in tube for high-strength CFRP screwing connections: b&m-CARBONCONNECT®

- Strong attachment point due to large screw-in depth
- Substitution of inserts or big-heads
- Avoids the failure of joints due to delamination
- Stress-tolerant design of the fiber profile by deflection
- Orthogonal alignment of the fiber path and tip
- Design possibilities:
 - Draping from component-own fabric
 - Introduction of additional fiber material (preform)
 - Laminating of a prefabricated tube is possible



baier & michels worldwide



Call us!

We analyze your screwing situation and offer you a non-binding technical consultation, upon request also on site. Our technical services include:

- Application engineering
- Process optimization
- Development of new connection systems

We also support you in the areas of procurement and logistics.

baier & michels GmbH & Co. KG

Carl-Schneider-Straße 1
64372 Ober-Ramstadt / **Germany**
Tel.: + 49 (0) 61 54 69 60 - 0
Fax: + 49 (0) 61 54 69 60 - 500
info@baier-michels.com
www.baier-michels.com

baier & michels S.r.l.

Viale Regione Veneto, 17
35127 Padova / **Italy**
Tel.: + 39 04 98 53 66 00
Fax: + 39 04 98 53 66 96
info@baier-michels.it
www.baier-michels.it

baier & michels USA Inc.

65 Brookfield Oaks Drive
Greenville, SC 29607 / **USA**
Tel.: + 1 864 968 1999
Fax: + 1 864 968 1234
usa@baier-michels.com
www.baier-michels.com

Wuerth baier & michels España S.A.

P.I. Can canals
C/ Formentera, 12
08192 Sant Quirze del Vallès
(Barcelona) / **Spain**
Tel.: +34 (0) 65 19 27 543
Fax: +49 (0) 6154 / 6960 99236
spain@baier-michels.com
www.baier-michels.com

baier & michels USA Inc.

2800 Superior Court
Auburn Hills, MI 48326 / **USA**
Tel.: +1 248 877 9956
usa@baier-michels.com
www.baier-michels.com

Würth baier michels Otomotiv Limited Sirketi

Minarelicavus Mahallesi
Çelik Cad. No: 11/1
16140 Nilüfer-Bursa / **Turkey**
Tel.: + 90 224 242 04 24
turkey@baier-michels.com
www.baier-michels.com

Wuerth baier & michels México S.A. de C.V.

Cerrada Bicentenario No. 3 Bodega 4
Fraccionamiento Parque
Industrial El Marqués
El Marqués, Querétaro
C.P. 76246 / **Mexico**
Tel.: +52 1 (442) 446 9047
mexico@baier-michels.com
www.baier-michels.com

Würth baier & michels Automotive Fastener Co., Ltd

No. 1969 Xizha Rd
Nanqiao / Fengxian District
Shanghai 201401 / **P.R. China**
Tel.: + 86 21 67 15 60 28
Fax: + 86 21 67 15 60 68
china@baier-michels.com
www.baier-michels.com