BÜFA

Composites

The new BÜFA-Toolingsystem

BÜFA-Tooling-Gelcoats:

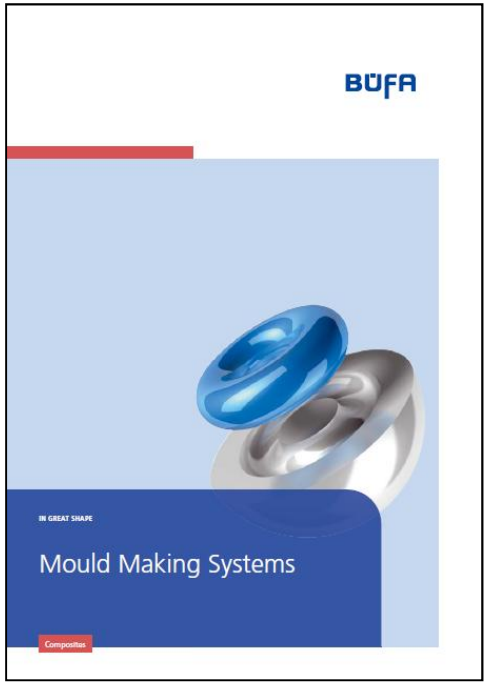
- BÜFA®-VE-Tooling-Gelcoat H/S natural, black, green
- NEW BÜFA®-Conductive-Tooling-Gelcoat H/S, natural, black, green

BÜFA 1st Layer-resin:

- NEW BÜFA®-Resin-VE 0910

BÜFA-Tooling resins:

- NEW BÜFA®-Resin-VE 7100 Tooling (up to 90°C)
- BÜFA®-Resin-VEU 1978 HLU (up to 120°C)



The new BÜFA-Toolingsystem

BÜFA®-Conductive-Tooling-Gelcoat
State-of-the-Art

Tooling gelcoats which are currently available for composite tool-making are by definition electrical insulators with a resistance of $>10^{12}\ \Omega$ and so are unable to carry electrical charge.

- static charge due to component separation (the triboelectric effect)
- discharge on humans, flammable materials or sensitive devices

The classical routes to conductive composites

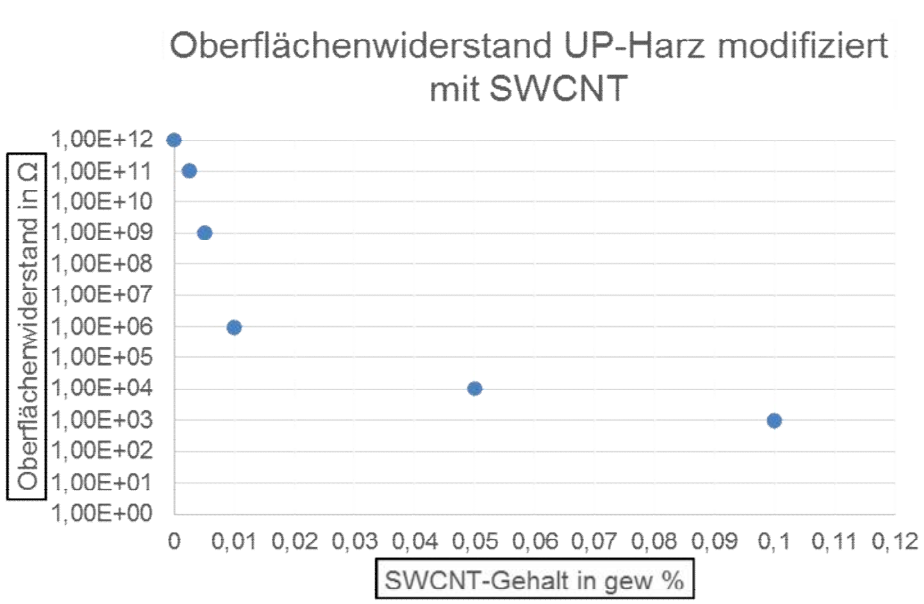
- Use of conductive carbon, graphite and C-fibres as conductive additives
- Dosing of 2-10% depending on the material
- Negative influence on:
  - mechanical properties
  - gloss
  - viscosity
  - colour
  - reactivity
- Not suitable for use in tooling-gelcoats

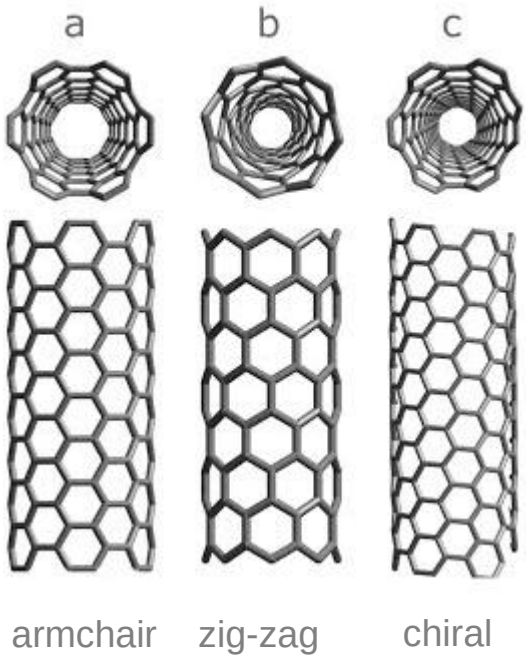
Innovative new technology - use of SWCNT

BÜFA has been working with Single Wall Carbon Nanotubes (SWCNT) since 2016:

- developing the basis for industrial use
- the greatest challenge was the industrial-scale isolation of the SWCNT normally present in bundles
- the base for all BÜFA® conductive products is a 1% SWCNT master batch in styrene-free resins

Innovative new technology - use of SWCNT



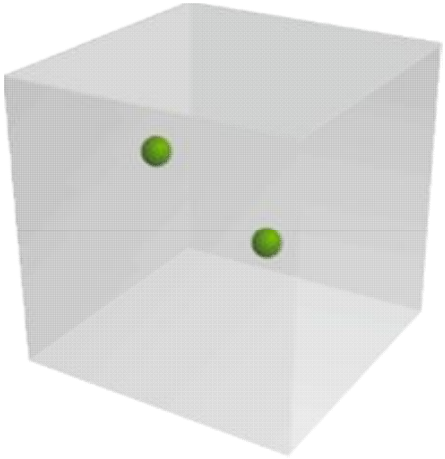


Source: M. Terrones, "Synthesis, Properties, and Applications of Carbon Nanotubes," Annual Review of Materials Research, vol. 33, no. 1, pp. 419–501, 2003.

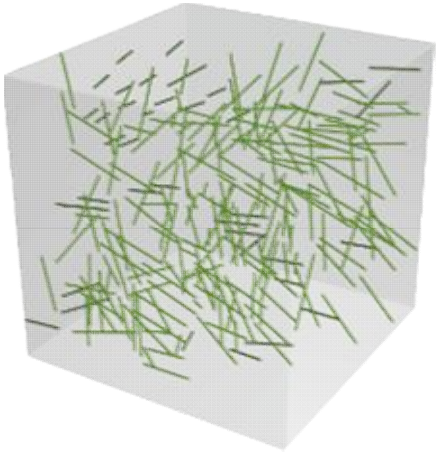
Extremely low dosing needed to generate a conductive network

Innovative new technology - use of SWCNT

0.1% particle concentration



Carbon black



Carbon fibre

SWCNT

Source: Ocsial.com

BÜFA®-Conductive-Tooling-Gelcoat

First presented in September 2017 at Composite Europe Show in Stuttgart

- approx. 15 t gelcoat has already been sold
- very positive feedback in relation to safety and duct attraction
- processed “like normal gelcoat”

Innovative properties of the BÜFA®-Conductive-Tooling-Gelcoat

Conductive tool surface with 10^6 Ω resistance combined with the familiar properties of a tooling-gelcoat.

A safety advantage for humans and the environment:

- no static discharge effects during demoulding when appropriately earthed
- no charge transfer to humans or flammable materials

Innovative properties of the BÜFA®-Conductive-Tooling-Gelcoat

Faster cycle times and improved tool quality:

- less dust on tool surfaces, hence better tool quality
- shorter re-coating times since cleaning steps are shortened
- lower demoulding forces required and thus easier demoulding and longer service life

Innovative properties of the BÜFA®-Conductive-Tooling-Gelcoat

BÜFA®-VE-Tooling-Gelcoat: Earthing

- BÜFA® Earthing Threaded Bolts M8x 50
  Article No. 026-8363 incl. nuts, washers and lock washers (conforms with VDE 0100)

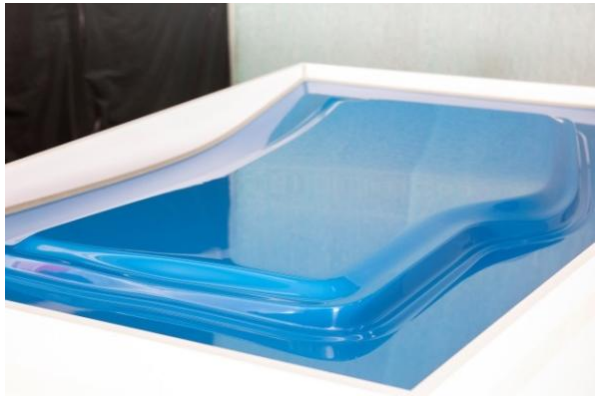
- BÜFA® Earthing Cable with Charge Clamp, Article No. 028-1325

- Use, positioning and number of surfaces→ TI BÜFA Tooling system

Innovative properties of the BÜFA®-Conductive-Tooling-Gelcoat

Other tested properties:

- consistent resistance values even after coating with release agent
- consistent resistance values after sanding and polishing
- very good gloss values after sanding and polishing

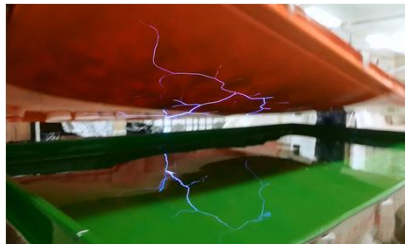


Summary

BÜFA®-Conductive-Tooling-Gelcoat offers:

the usual properties of a tooling-gelcoat

+ electrical conductivity (TÜV certified)
+ safety advantages (use in EX zones 2, 1 and 0)
+ improved tool quality
+ faster cycle times due to shortened cleaning steps
+ increased service life for the tools
+ new opportunities for innovative processing methods

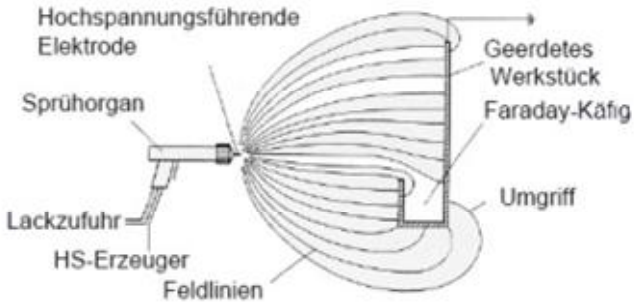


Outlook for E-Static-Spray-Procedure

New innovative processing methods for the composite sector arise from the new tool surface properties

BÜFA-patent for gelcoat spraying in electrostatic processes

- significantly reduced overspray
- better materiel yield
- greatly reduced emissions

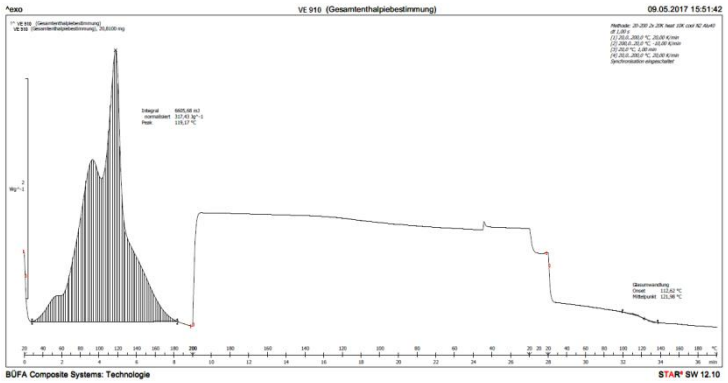


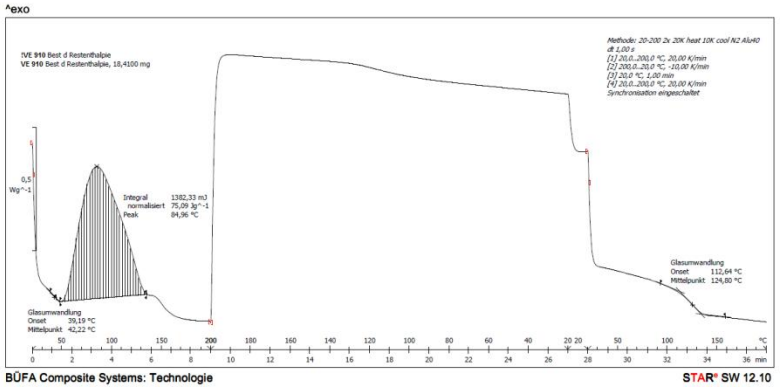
Source:http://www.airlessgeraete.com/Leiste1/elektrostatic.htm

NEW

1st Layer-Resin: BÜFA®-Resin-VE 910

- Previously Atlac 580ACT → new recommendation BÜFA®-Resin-VE 0910
- improved material hardening → less shrinkage → **less rippling**





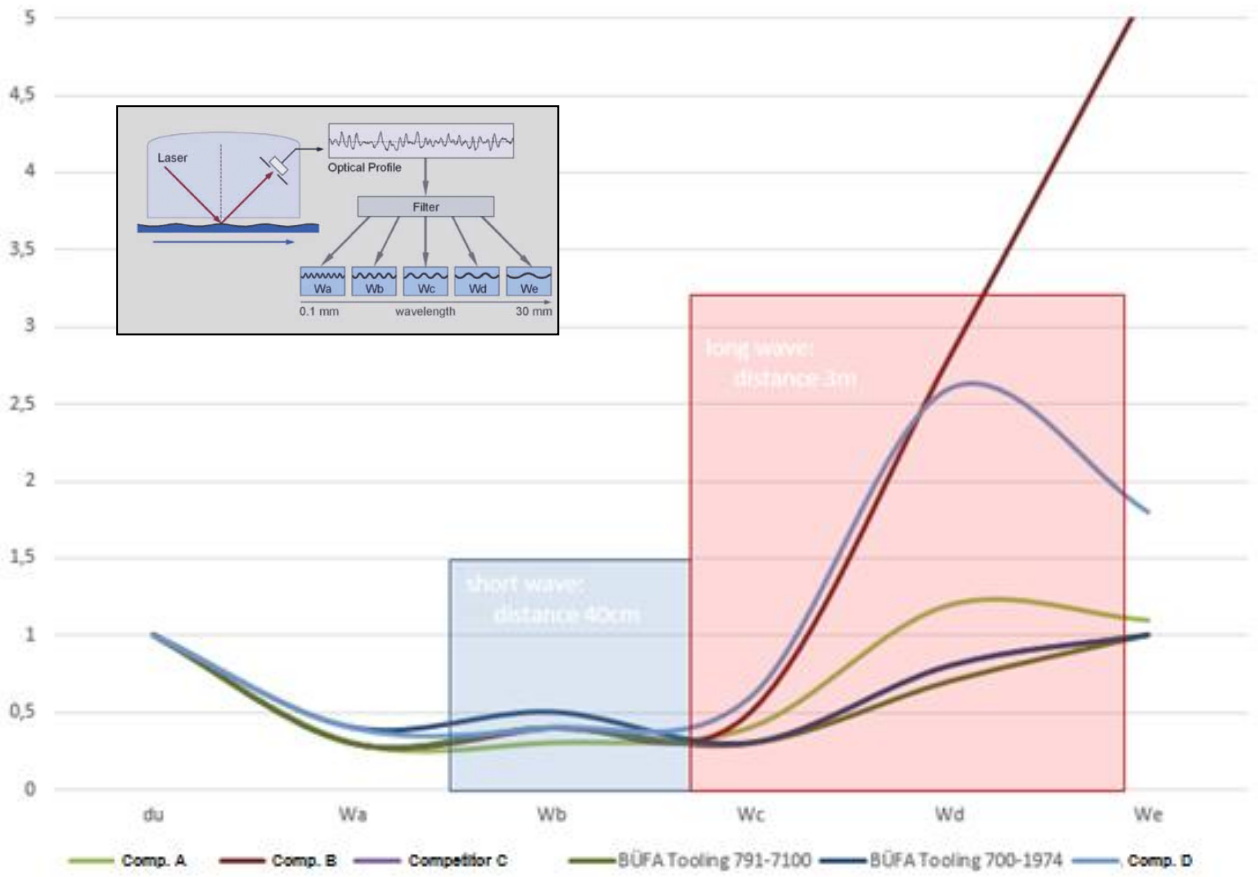
- higher heat deflection temperature → **improved long-term surface stability**

DSC TG_{mid}: Atlac580ACT: **90°C** / BÜFA®-Resin-VE 910: **120°C**

NEW
BÜFA®-VE-Tooling-Resin 700-7100

- Vinyl-ester with low profile additives and fillers for anti-shrinking process
- In Benchmark, the resin had
    - the lowest VOC content < 30%
    - the best processability
        - excellent fibre wetting
        - trapped air is easy to recognise due the resin's inherent colour (translucence)
        - extremely simple degassing
    - the highest heat deflection temperature 75A HDT (91°C)
- special hardening characteristics enable the build-up of both
    - thin (**2**x450g/m²CSM) and
    - thick laminates (**12**x450g/m²CSM → Tmax: 60°C)
- Barcol: 42(RT) / 58(tempered)
- top mechanical properties
- Tested processing methods: hand lay-up and spray lay-up processes

Benchmark - Surface Rippling after Aging

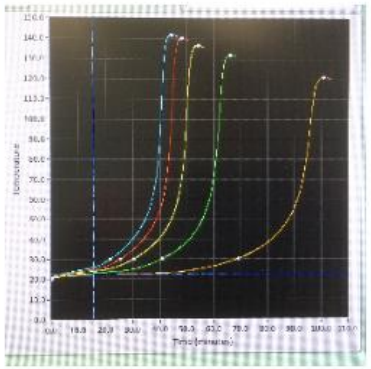


BYK Wave-Scan Dual

BÜFA®-VE-Tooling-Resin 700-7100 - Reactivity

Reactivity with different MEKP-ratios - 700-7100 + CuroxM303 / CuroxM103 (%) - 20-30°C-messurement 100g-beaker

	Geltime (min.)	t-Tmax (min.)	Tmax (°C)
1,0 Curox M303	69	101	121
1,5 (rcmd) Curox M303	**41**	**66**	**132**
Curox M103	**51**	**77**	**131**
2,0 Curox M303	30	54	137
Curox M103	40	63	135
2,5 Curox M303	25	48	140
3,0 Curox M303	22	44	142



Curox M303 reactivity-curves

empfohlen: 1,5 %

okay: 1,0 und 2,0 %

nicht empfohlen: 2,5 und > 2,5%

Summary

BÜFA NEW Tooling-System

- meets required safety standards
- ideal workability
- high gloss and optimised surface stability
- low mould maintenance requirement
- competitive price level

Application Sectors

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