STRECON
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Steifigkeit als Armierungsparameter

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Agenda

1. Strecon im Überblick
2. Beispiel aus der Simulation
3. Mit Hartmetall steifer armieren
4. Der Versuch mit Kohlenfaser steifer zu armieren
5. Erkenntnisse
6. Ansatzpunkte für die weitere Erforschung

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STRECON im Überblick

thyssenkrupp
LEGO
LINAK WE IMPROVE YOUR LIFE
SFS
FELSS The smarter way of forming.
SMITH
GRUNDFOS
BOSCH
University of Zurich
Sumitomo
NICHIDAI
HEWI
SIEMENS Gamesa RENEWABLE ENERGY
cnrs
MUELLER INDUSTRIES
SCHAEFFLER
DENSO Crafting the Core
AAM
UNIVERSITY of WASHINGTON
LINAMAR
GOETHE UNIVERSITÄT FRANKFURT AM MAIN
Sintex
FAU FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
neapco
UNIVERSITÉ DE GENÈVE
UNIVERSITY OF CANBERRA
ZF
UNIVERSITÄT BAYREUTH
PEINER Umformtechnik
metallumform

Owners of STRECON /
Christian Jepsen (front) and Erik Lund

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Produktpalette

PRESTRESSING TOOL SYSTEMS

Precision Forging (PF)

Prestressing tool solutions and systems for precision forging and comparable metal forming applications.

Applicable for cold, warm, and hot forming processes.

High-Pressure Synthesis (HPS)

Prestressing tool solutions and die alignment system for the belt type system and the Toroid anvils system.

Applicable for the manufacturing of industrial diamonds / CBN products up to 80 kbar pressure level.

High-Pressure Experiments (HPE)

Prestressing tool solutions and systems for HP/HT experiments performed by end-loaded and non end-loaded vessel systems.

Applicable for HP/HT experiments up to 50 kbar pressure level.

Carbide Tooling from Japan

High-quality carbide tooling from Japanese tool manufacturers.

Applicable for processes like cold forming, cutting, and punching as well as other wear parts.

MACHINE & EQUIPMENT SOLUTIONS

RAP – Robot Assisted Polishing of Tools and Molds with 2D & 3D Geometry

Robotic machine system for precision polishing of tools and molds with 2D and 3D geometry.

Applicable for metal forming tools and injection molds.

HPE Press System for High-Pressure / High-Temperature Experiments

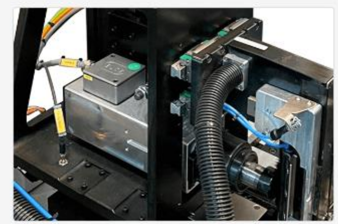
HPE-Press for high-pressure and/or high-temperature experiments.

The HPE-Press is designed for 320T in press frame but can be customized to other press needs.

TAP – Tool Assembly Press for Assembly and Disassembly of Various Tools and Dies

Hydraulic press for assembly and disassembly of various metal forming tools.

Applicable for press fitting of tools needing up to 650T in press force.



Special Equipment Solutions for Individual Customers

Development, manufacturing, and delivering of machinery and production equipment for individual customers.

Applicable for multi-disciplinary production equipment solutions involving for example part pressing, precision measuring, cooling, and fine machining.

Schwerpunkt dieser Präsentation

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PRODUCT PROGRAM / PRECISION FORGING

Prestressing tool solutions and systems for precision forging and comparable metal forming applications.

Applicable for cold, warm, and hot forming processes.

PTS - Prestressing Tool System / H-Type
Tool system developed for horizontal press machines

PTS - Prestressing Tool System / V-Type
Tool system developed for vertical press machines

SC 200 / SC 400
Stripwound container for radial prestressing of cold or warm forming dies

SC 200+ / SC 400+ | E+ Container Type
Stripwound and high stiffness container for radial prestressing of cold and warm forming dies

SC AXI-FIT
Stripwound container system for radial and axial prestressing of forming dies for cold and warm forming applications

Double Ring
Compression ring of two or three rings designed for radial prestressing of forming dies

Customized Tool Solutions
Special prestressing tool solution designed specifically for a customer's press equipment

Schwerpunkt dieser Präsentation

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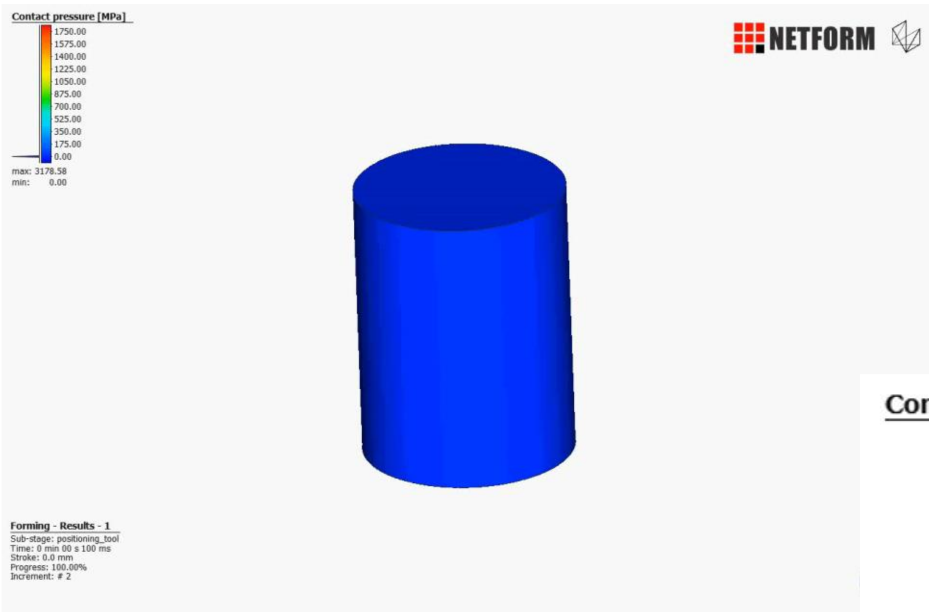
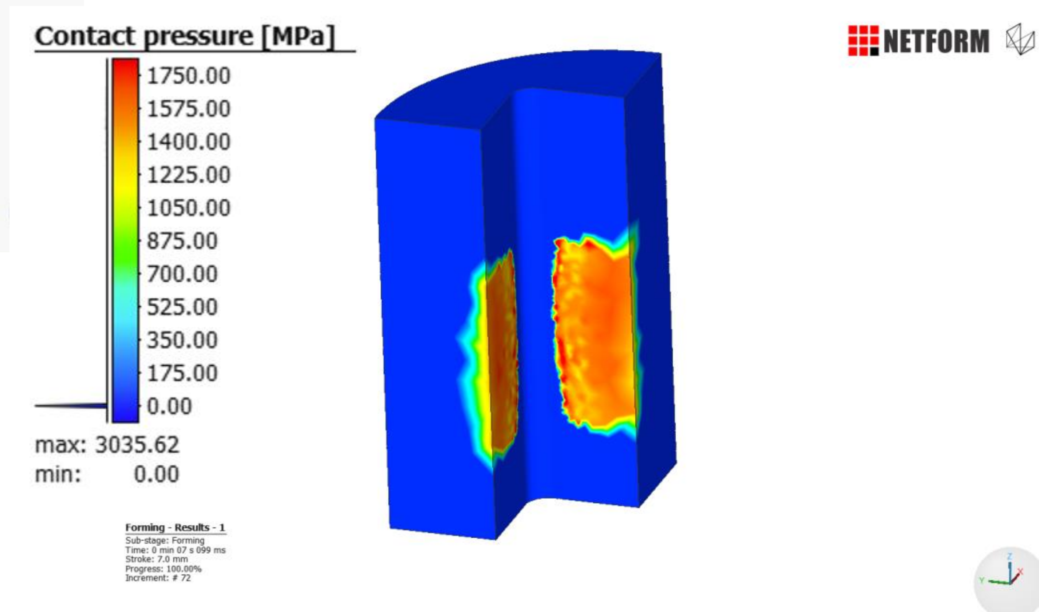
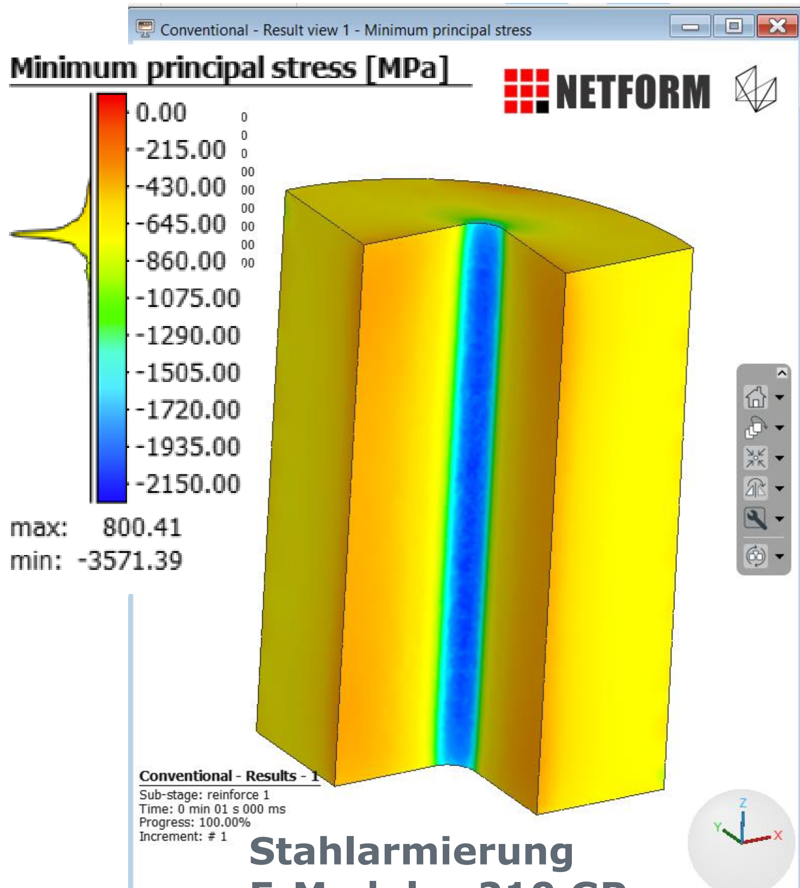
Beispiel aus der Simulation:

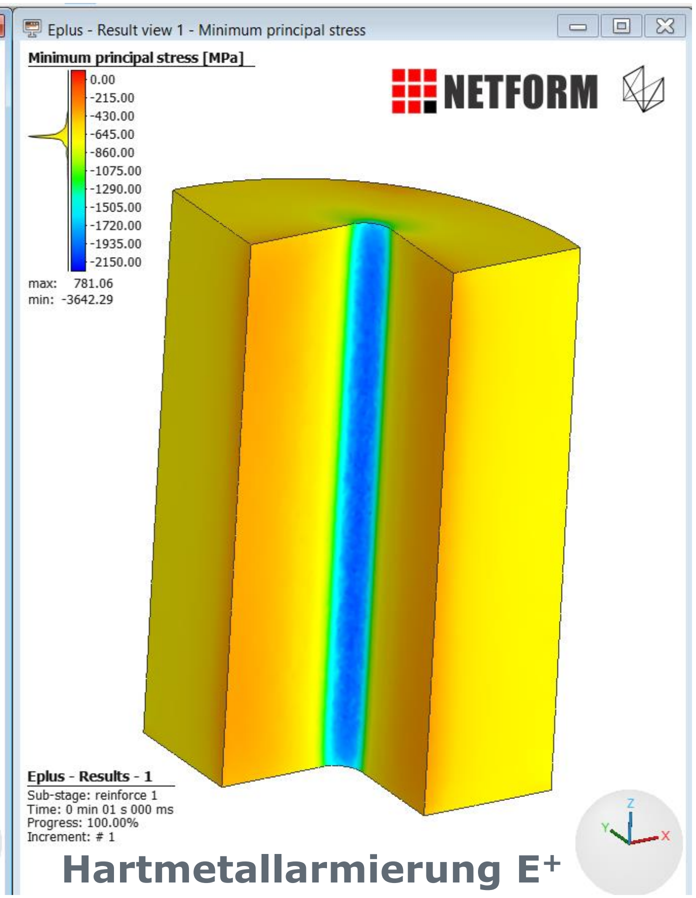




Vorspannung

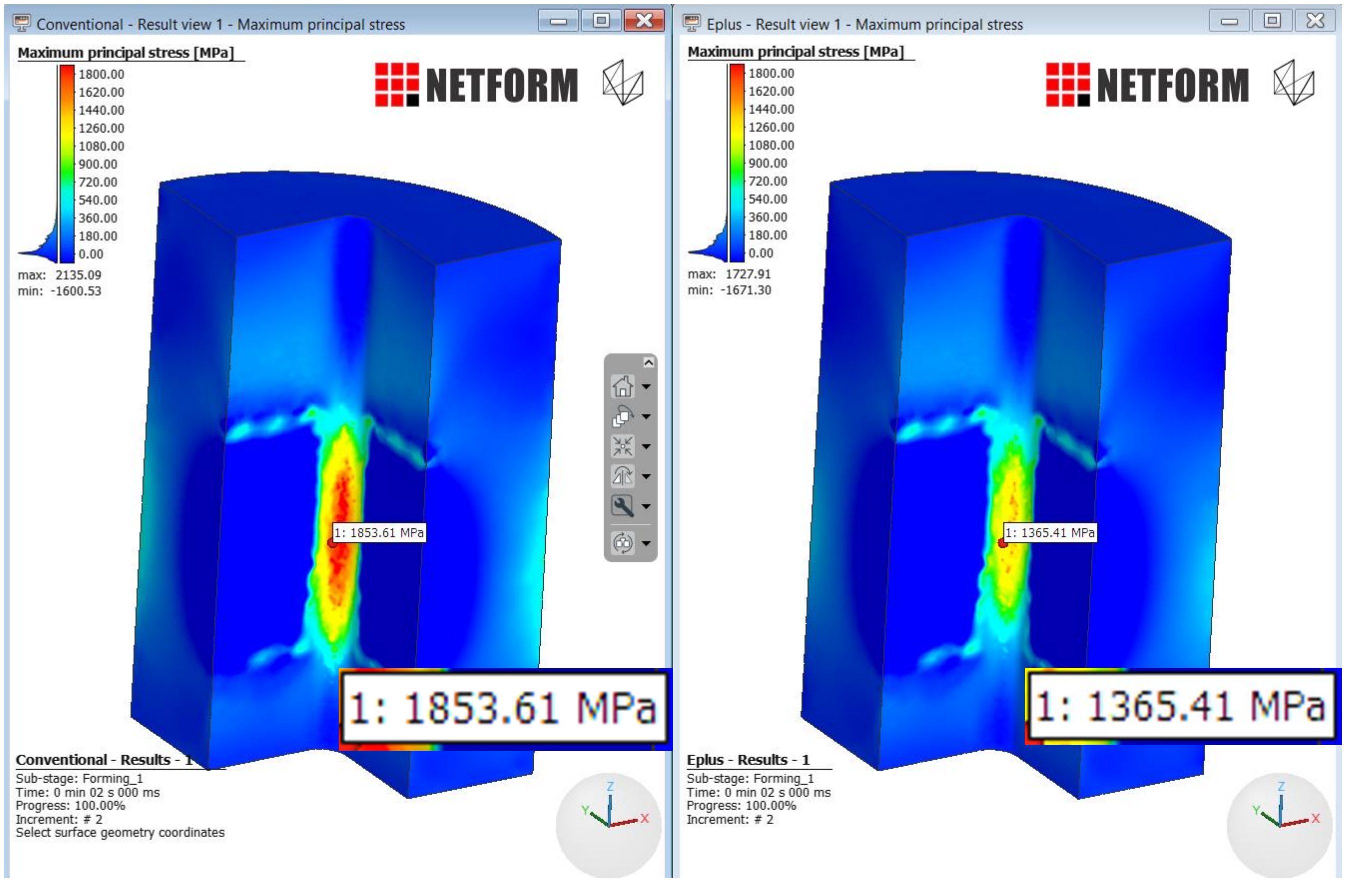


Stahlarmierung
E-Modul = 210 GPa
Übermaß = 5,0‰

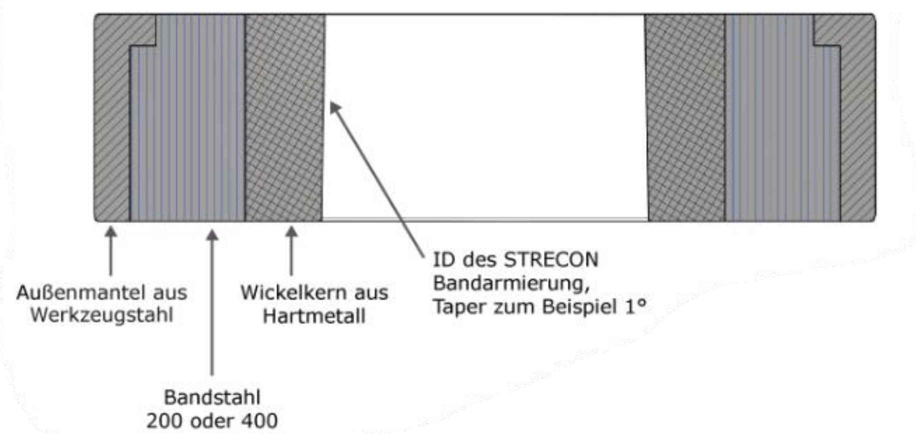


Hartmetallarmierung E+
E-Modul = 380 GPa
Übermaß = 3,9‰

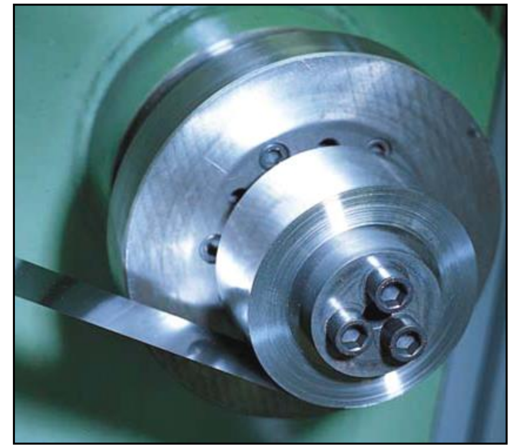
1. Hauptspannung mit Umformdruck

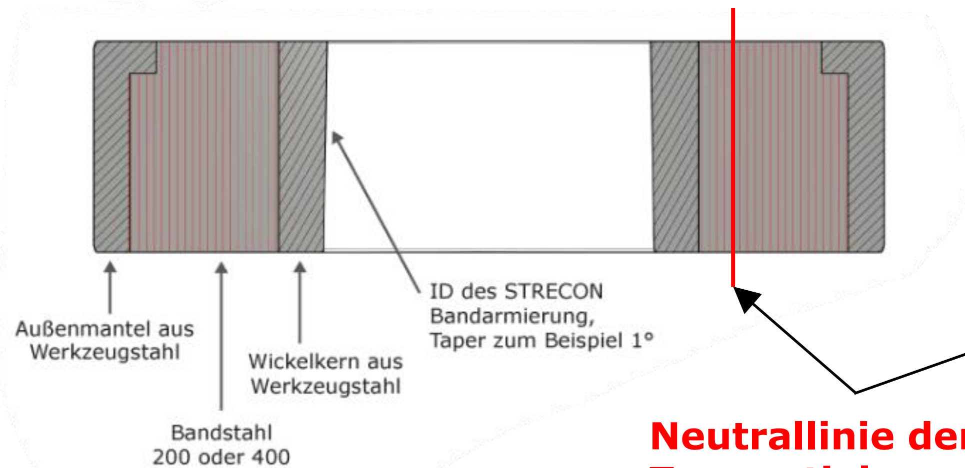


Mit Hartmetall steifer armieren

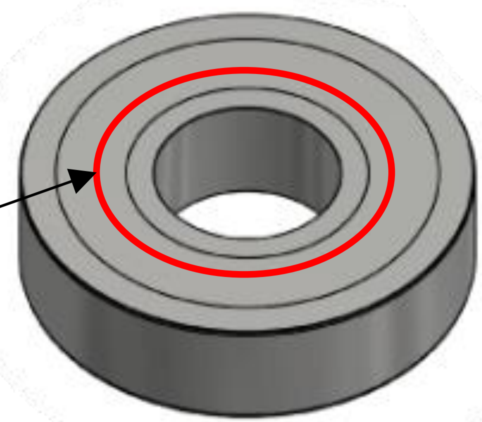


E+

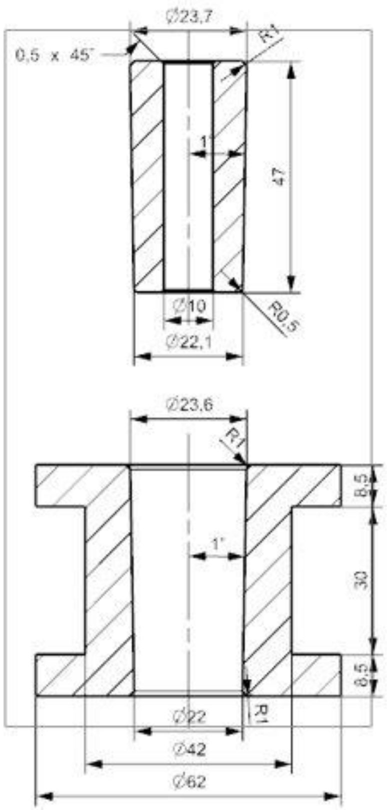


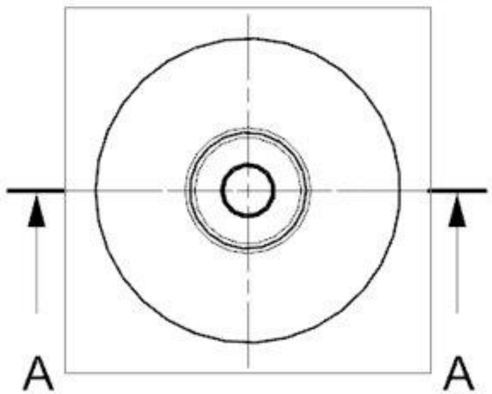


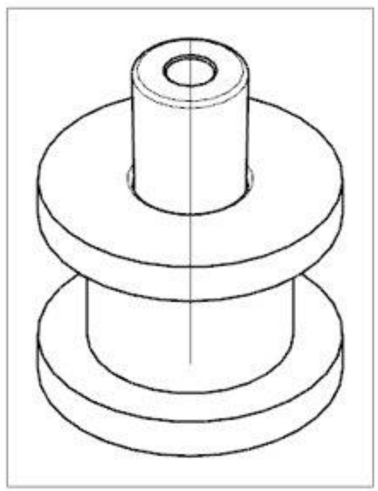
Neutrallinie der Tangentialspannung

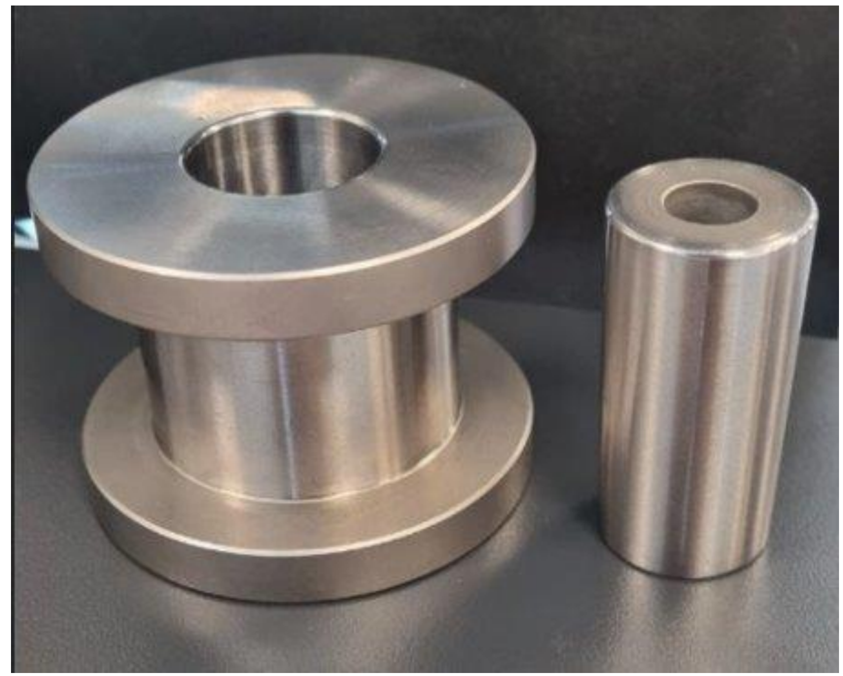


Faserarmierung: Ein Prototyp im Spulendesign

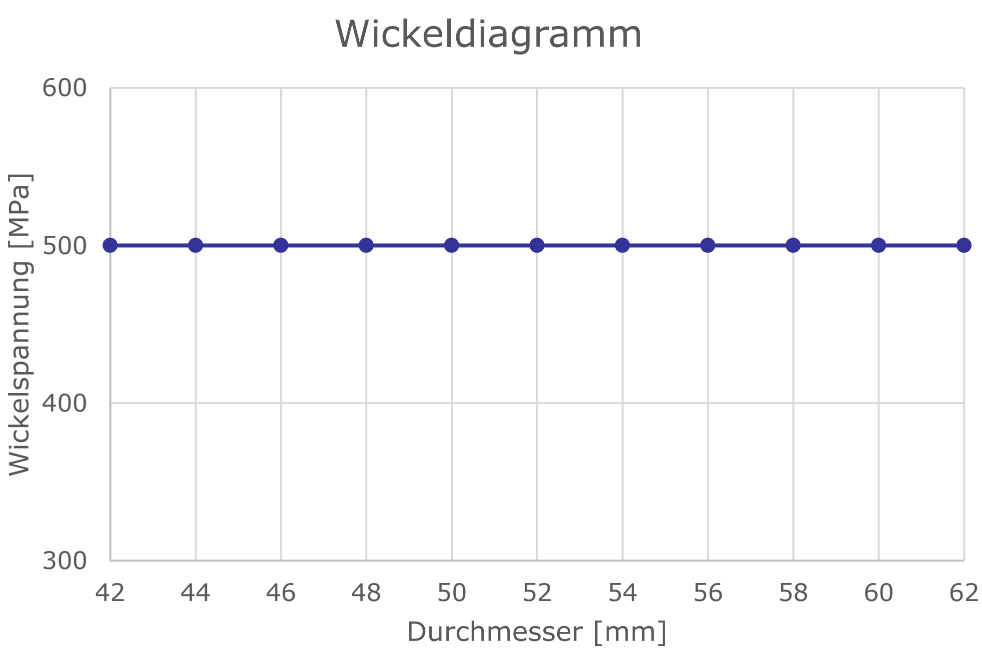


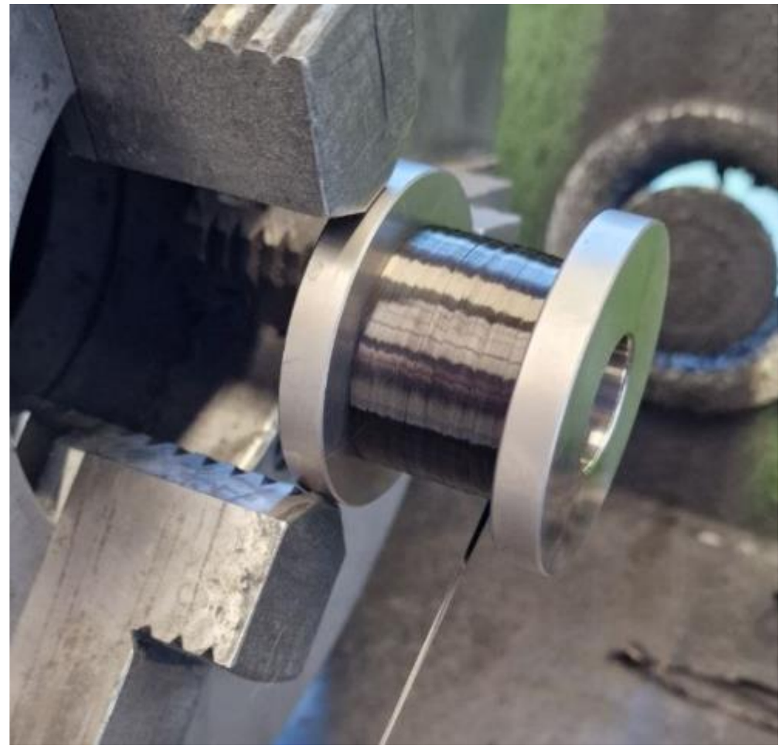






Wickelprozess





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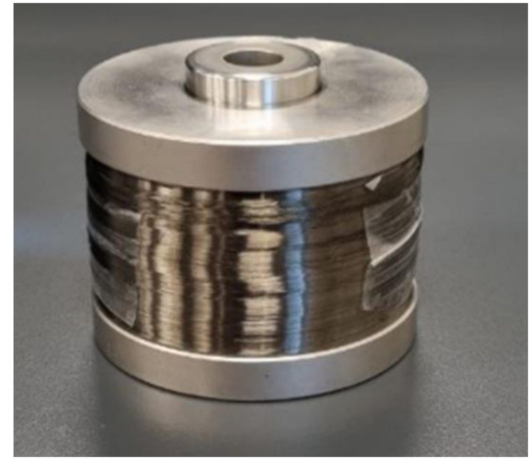
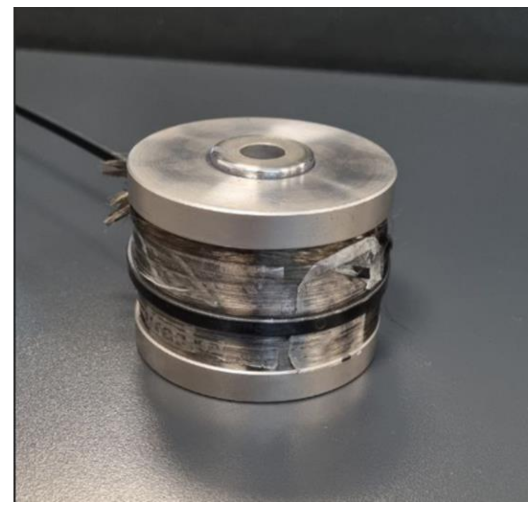
Steifigkeit im Vergleich

$$\Delta d = d_1 - d_2 = 10{,}248 - 10{,}211 = 0{,}037$$

d_1 = Ausgangsdurchmesser der Matrize.
d_2 = Innendurchmesser mit 4,26 ‰ Vorspannung.



	Kohlefaser	Stahl
E-Modul	290 GPa	210 GPa
Kontraktion	0,037 mm	0,039 mm (1)
Übermaß	4,26 ‰	4,26 ‰



Fazit:

- Der E-Modul der Kohlenfasern ist 38% höher.
- Die Kontraktion der Matrize ist 6% kleiner.

(1)Theoretisch ermittelter Wert.

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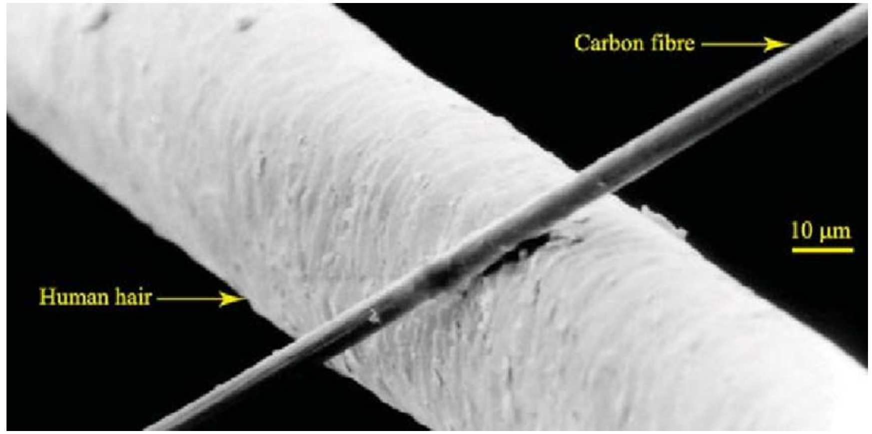
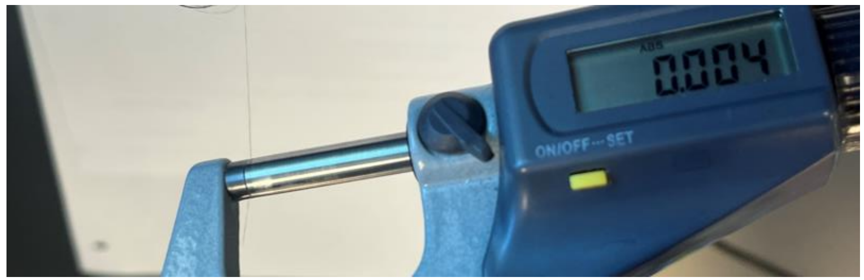
Analyse der einzelnen Fasern

	Datenblatt	Ermittelt
Zugfestigkeit [MPa]	6000 MPa	~1300 MPa
Zugfestigkeit einer Faser [N]	0,12 N	~0,026 N
Faserdurchmesser [µm]	5 µm	4 µm



https://www.researchgate.net/figure/Carbon-fiber-compared-with-human-hair-photo-credit-Anton_fig3_283308870

Es war nur möglich, eine Zugfestigkeit im Bereich 20-25 % vom Datenblattwert nachzuweisen.



Erkenntnisse:

- Es wurde keine erhöhte Steifigkeit mit der Kohlenfaserwicklung nachgewiesen.

- Die Zugfestigkeit der Kohlenfasern konnte nur zu 20-25 % genutzt werden.

Ansatzpunkte für die weitere Forschung:

- Festlegung der Zugfestigkeit
- Ermittlung der Drucksteifigkeit
- Faserversagen und Sicherheit
- Wärmeleitung
- Strukturelle Steifigkeit