

# Bavarian research & innovation



Bavarian Research Cooperation for Carbon-Based Materials

## ON DIAMONDS AND NANOTUBES

FORCARBON is investigating three areas of interest:

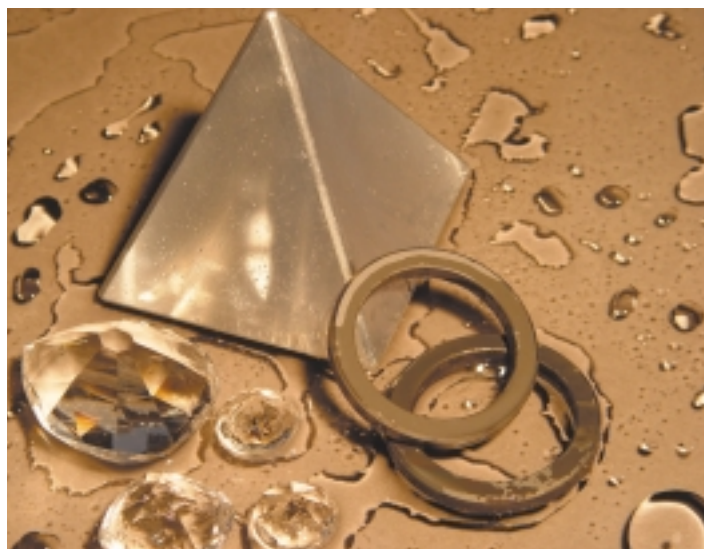
### I. Coatings from diamond and diamond-like carbon

Crystalline diamond layers to protect against wear on very highly stressed structural steel members could significantly improve function and service life. It has not previously been possible to coat steel with diamond because the two

materials do not bond together. FORCARBON intends to solve this problem with intermediate layers that improve adhesion. High quality diamond detectors, used primarily for medical radiation measurements, consist nowadays in natural single crystals. These are very rare in the necessary size and purity, and are correspondingly expensive. FORCARBON intends to grow the world's largest diamond crystals industrially.



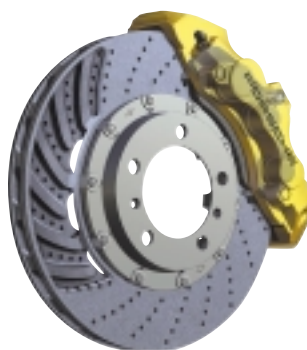
Verschleiß einer Stahl-Wurfschaufel



Diamantenbeschichtete Verschleißteile

### II. Carbon-based composite materials

FORCARBON is developing composite materials based on carbon having unique properties for many applications. These materials are very light and extraordinarily resistant to temperature and corrosion, therefore making them suitable as a base material for brake discs or high-performance pumps. The market for composite materials is growing rapidly, as the industry incurs high losses annually due to friction and wear.



### III. Special carbon morphologies

In addition to carbon's familiar allotropes, such as diamond and graphite, new types of structure such as aerogels and nanotubes have recently been developed. They are characterised by an extraordinarily large internal surface, and are valuable as catalyst carriers, for exhaust fume cleaning or heat insulation in high temperature applications. Nanotubes, furthermore, can also be formed into small, stable printed conductors with low resistance, functioning almost like an electron helter-skelter, and are therefore suitable as components for the nanocomputers of the future. FORCARBON is researching the principles required for scaling up the production and further processing of these new types of carbon.

links: [Bremsscheibe aus einem Grafitfaser-SiC Verbundstoff](#)

#### Spokespersons:

Prof. Dr.-Ing. Robert Singer, University of Erlangen-Nuremberg  
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# RESEARCH TOPICS:

## I. Coatings from diamond and diamond-like carbon

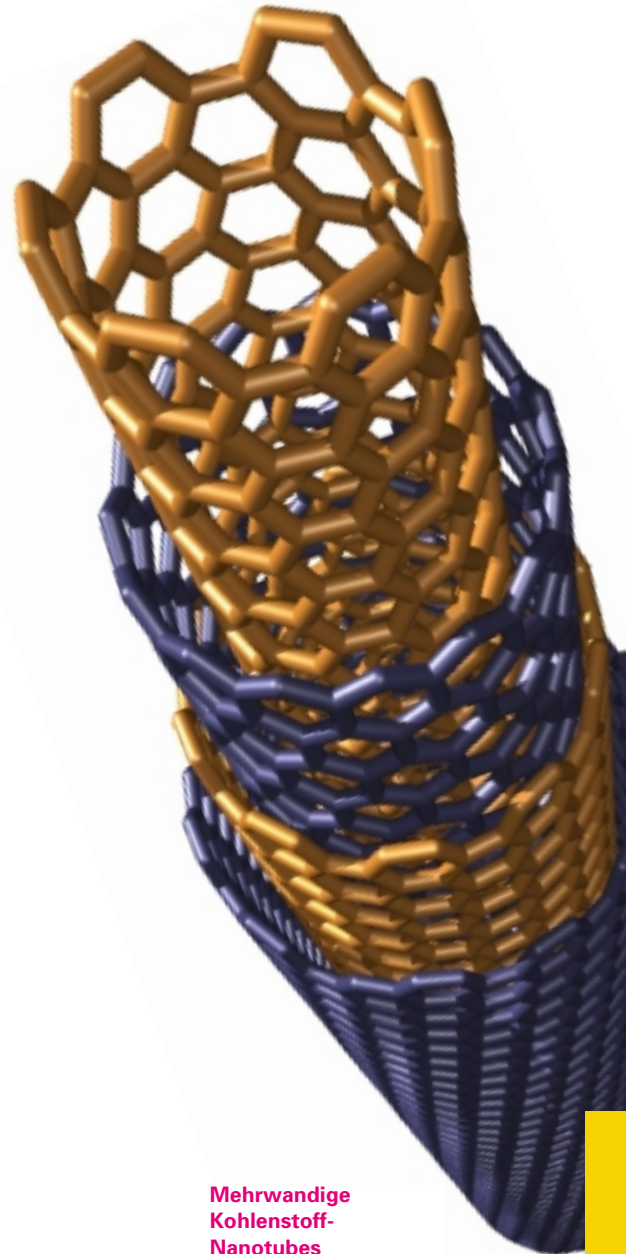
- Diamond detectors for radiation dosimetry (Dr. Schreck, University of Augsburg)
- Selective laser excitation of diamond and fullerene materials: application in sensor technology and identification marking (Dr. Bogner, University of Regensburg)
- Optimisation of the wear resistance of pairs of sliding materials in diesel injection systems for motor vehicles with low fuel consumption (Prof. Meerkamm, University of Erlangen-Nuremberg)
- Diamond on steel (Prof. Singer, University of Erlangen-Nuremberg)

## II. Carbon-based composite materials

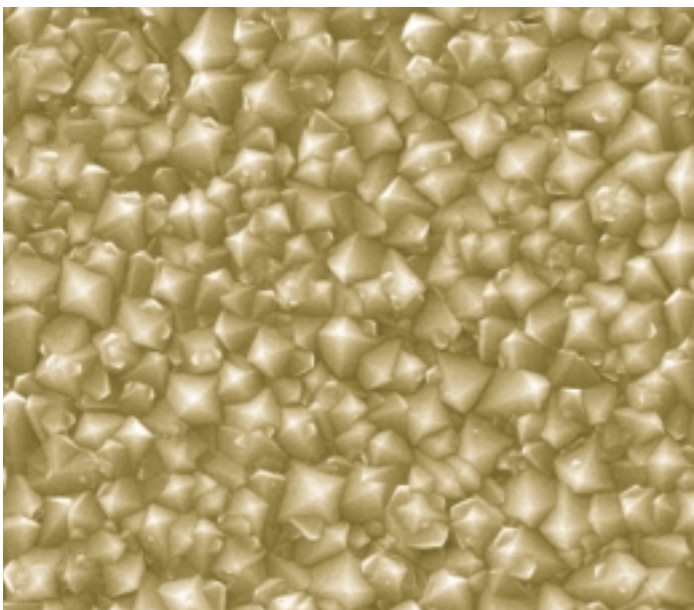
- Improvement of the oxidation properties of short-fibre-reinforced C/SiC ceramics (Prof. Müller, FhG ISC Würzburg)
- Optimisation of the interface in carbon-fibre-reinforced composite materials through CVD coating of short carbon fibres (Dr. Popovska, University of Erlangen-Nuremberg)
- Manufacture of novel substrate materials through infiltration with diamond from the gas phase (Dr. Rosiwal, University of Erlangen-Nuremberg)

## III. Special carbon morphologies

- Nanoporous high-temperature sol-gel-based materials (Prof. Fricke, University of Würzburg)
- Carbon composite materials with special morphologies for catalytic and electrochemical applications (Prof. Willert-Porada, University of Bayreuth)
- Development of materials based on functionalised single-wall carbon nanotubes (Prof. Hirsch, University of Erlangen-Nuremberg)
- Chemical and structural characterisation of functionalised and non-functionalised carbon nanotubes (Prof. Ley, University of Erlangen-Nuremberg)



Mehrwandige  
Kohlenstoff-  
Nanotubes



Diamant-Schutzschicht

## Partners in industry

Dr. Pychlau GmbH, Freiburg; BGS GmbH & Co. KG, Saal a. d. Donau; DiaCeram GmbH, Stahnsdorf; Semikron GmbH, Nuremberg; MIPA AG, Essenbach; IXYS GmbH, Lampertheim; Siemens VDO Automotive AG, Regensburg; Balzers AG, Lichtenstein; INA oHG, Herzogenaurach; H-O-T GmbH & Co. KG, Nuremberg; Rösler GmbH & Co. KG, Untermerzbach; SGL Brakes GmbH, Meitingen; DaimlerChrysler AG, Ulm; Dornier GmbH, Friedrichshafen; Schunk GmbH, Gießen; Sintertechnik GmbH, Pretzfeld; Linn High Therm GmbH, Eschenfelden; Plansee GmbH, Lechbruck; CemeCon AG, Aachen; SGL ACOTEC GmbH, Meitingen; SGL Technologies GmbH, Meitingen; Superior Graphite Co., Höhr-Grenzhausen; Varta Gerätebatterie GmbH, Ellwangen; Siemens AG Forschungszentrum, Erlangen; FutureCamp GmbH, Munich; Infineon Technologies AG, Munich.