



The Schunk Group Strong Together

Meeting
IEA Bioenergy Task 34

Materials Engineering

Carbon | Graphite | Fiber composites
| Ceramics | Sinter Metals | Quartz

We are
leading in

#1

Machine Building

Environmental Simulation | Industrial ovens |
Air conditioning and clean room technology |
Ultrasonic welding machines | Optical machines |
Laser machining

Organizational structure Schunk Group

Holding

Schunk GmbH

Divisions

Materials

Machinery & Equipment

Business Units

Industry

Ceramics

Transit

Microelectronics

Mobility Carbon

Sinter Metals

Environmental Simulation

Air Solutions

OptoTech

Sonosystems

Schunk worldwide





Schunk Carbon Technology GmbH

Bad Goisern am Hallstättersee, Austria





SCHUNK CARBON TECHNOLOGY GMBH

Dr. Florian Preishuber-Pfluegl

R&D Railway Technology

Head of Materials Engineering

Interests

- **Biobased Solid Carbon Raw Materials**
- **Biobased Binder Materials**

Mobility Carbon

Automotive:

Electrical components in modern motor vehicles are the driving force behind pioneering solutions in powertrain, driving safety and comfort.

Thermal Management:

Customized graphite composites provide solutions that optimize back-end processing in power electronics assembly, or thermal runaway propagation prevention in lithium-ion battery packs.



**BUSINESS
UNITS**

Transit Systems

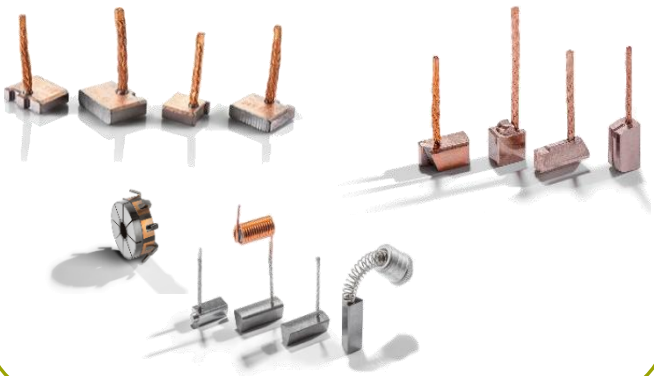
Rail:

Carbon solutions for power transmission in long-distance and local public transport, for locomotives, trams, metro systems, etc.

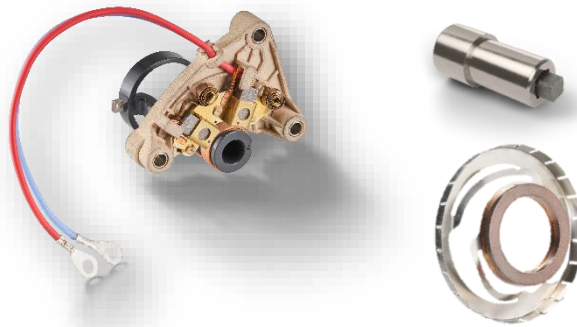
BUSINESS UNIT MOBILITY CARBON

SCHUNK BUSINESS AREAS

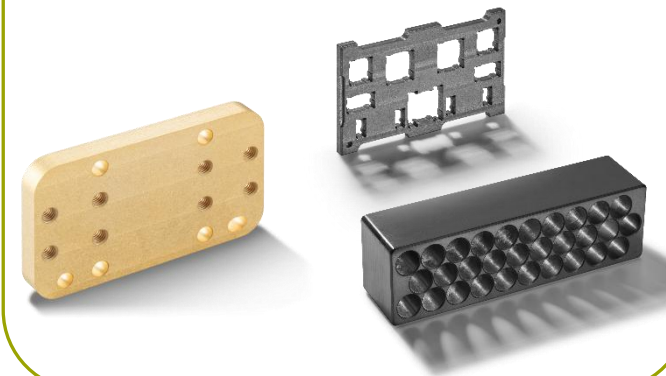
ELECTRICAL CARBON



TRACTION SYSTEMS



THERMAL MANAGEMENT



BUSINESS UNIT TRANSIT SYTEMS

SCHUNK BUSINESS UNIT AREA RAIL AFTERMARKET

ALL CARBON



MULTI-COMPONENT



HIGH CURRENT



3rd RAIL COLLECTOR
SHOES



HIGH SPEED, EMU, ...

Carbon strip:

- integral carbon strip
- insulated endhorn „fire and smoke“ cert.
- auto drop device with special tube
- ALL CARBON arc protection for long life
- aerodynamic optimized
- arc protection for aluminum carrier
- carbon covered endhorn area
- Copper covered carbon (Kasperowski) for difficult contact wire conditions
- RAMS optimized



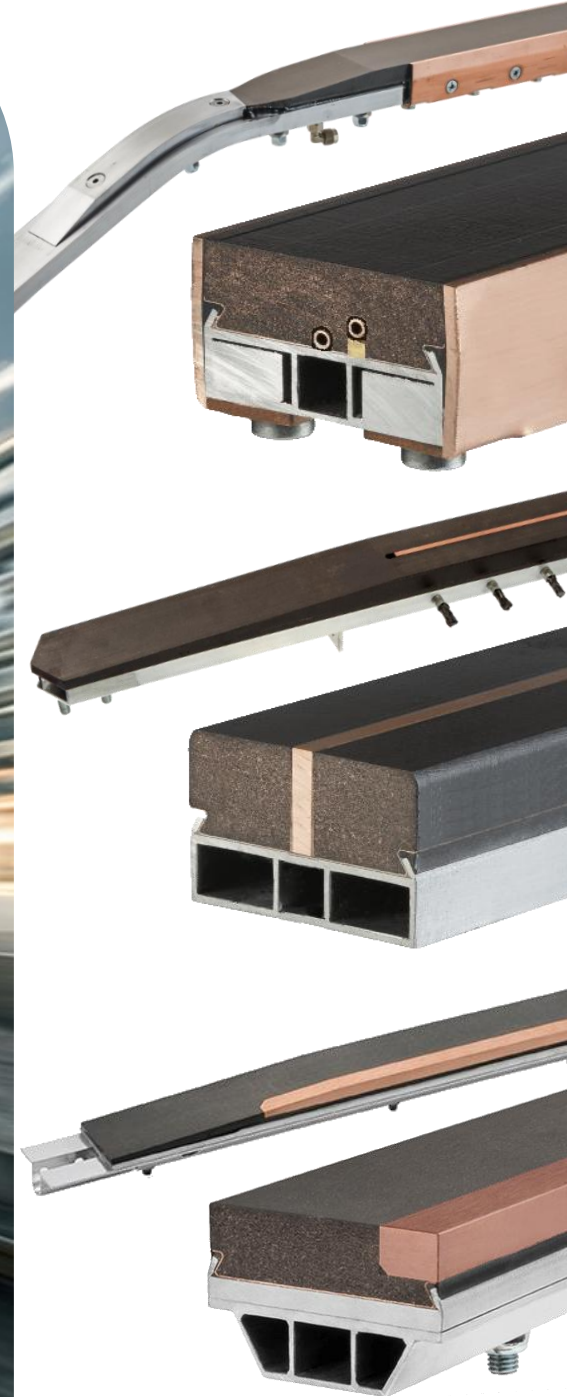
LOCOMOTIVES, TRAM, ...

High-current carbon strip:

- maximum performance at highest current load (copper inserts)
- wear detection and auto drop device --> twin tube design

Convertible carbon strip:

- Convertible CARBON; ICE CUTTER;
- Re-usable aluminium carrier with heater elements
- LCC optimized



METRO, PEOPLE MOVER, ...

3rd Rail composite collector shoe

- Third-rail carbon collector shoe with overrun/stop protection

3rd Rail carbon collector shoe

- Third-rail carbon collector shoe for composite busbars

People Mover collector shoe

- People Mover collector shoe for composite busbars



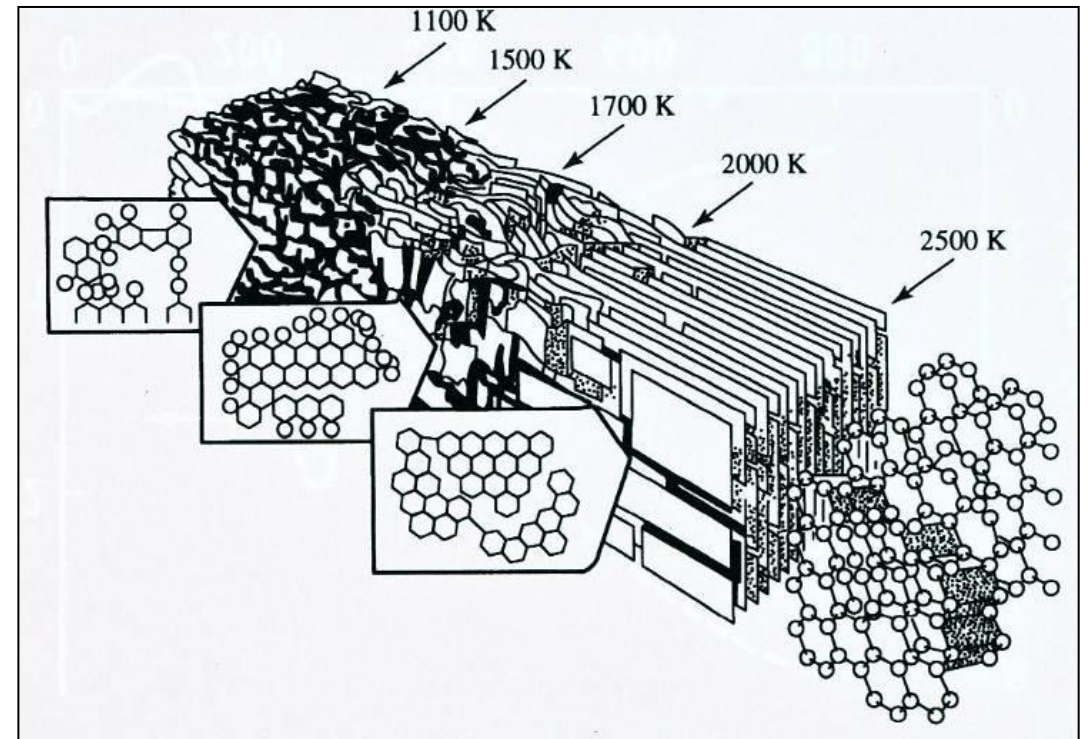
We need suitable Raw Materials to manufacture Carbon Materials.

Today we rely on established raw materials with known chemical and structural properties that can be transformed into **technical carbon materials** with distinct electrical and mechanical properties.

Coke, Graphite, Carbon Black, Coal Tar Pitch.

Coke and Coal Tar Pitch can be graphitized at high temperatures to yield pure synthetic graphite.

Stakeholders: The Carbon and Graphite Industry.

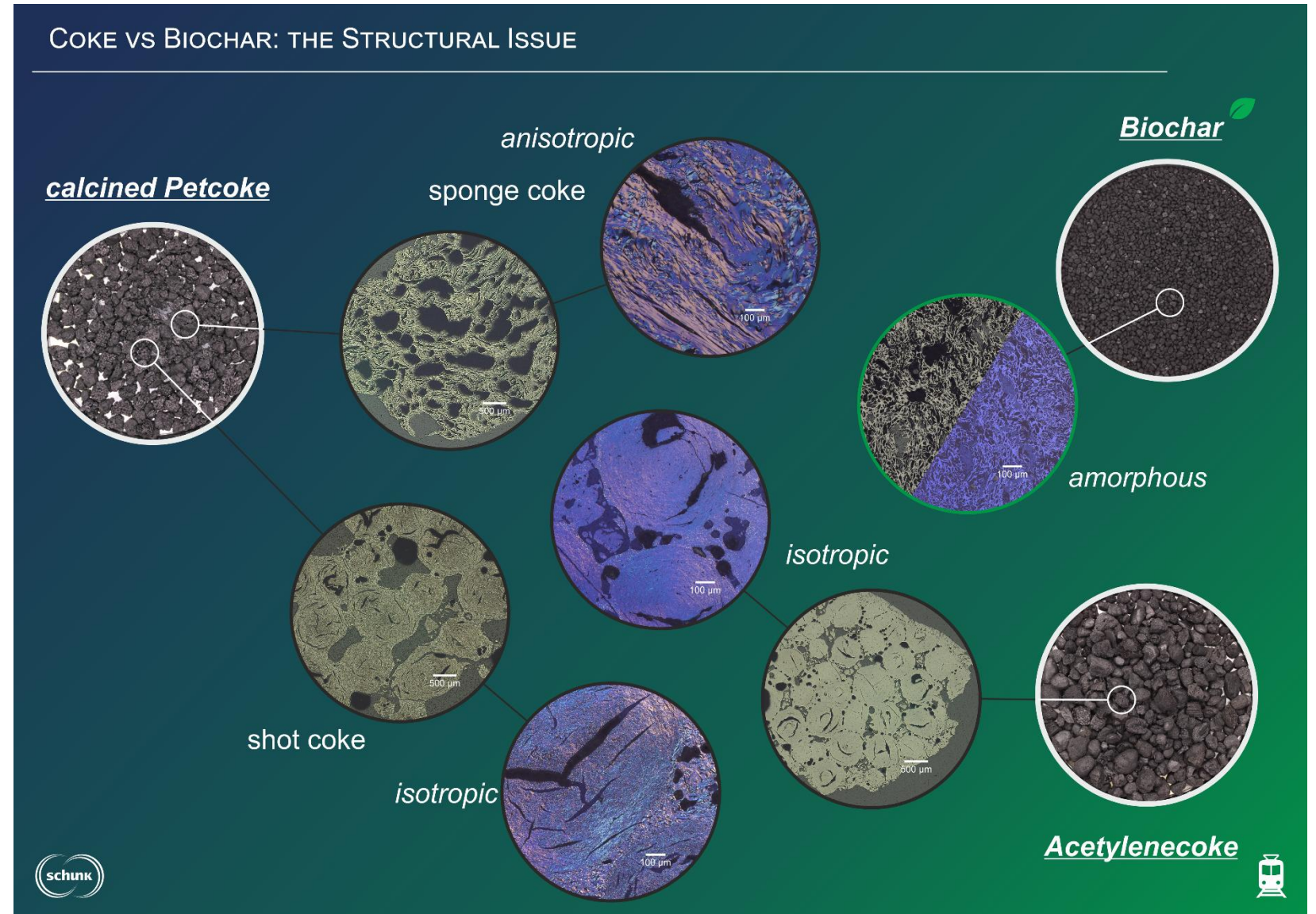


Ubbelohde *et al.* 1963.

Coke vs Biochar

- Coke shows high density and pronounced layered structures
- Biochar yields porous, amorphous carbon

Differences in *e.g.* structure and chemical, electrical, mechanical and thermal properties.



- **Coal Tar Pitch -- Carbon Strips and Graphite Anodes**

Chemically stable up to 200°C for long time

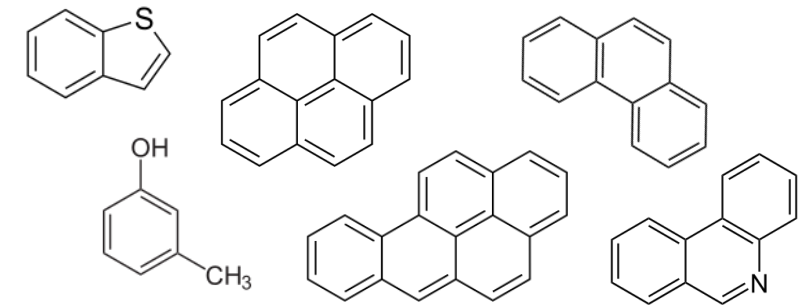
softening point ~ 100°C up to 250°C

C H N S O ~ 92-94 / 4 / 1 / <1 / 1-2

broad molecular mass distribution, many (!) components

> applicable for piston extrusion

> can be converted to coke and graphite



typical Coal Tar Pitch compounds

- **Thermosetting Resins -- Carbon Brushes, Composite Materials**

Phenolic Resins – Furan Resins – Epoxy Resins

higher reactivity at high temperatures (crosslinking)

> yield amorphous carbons

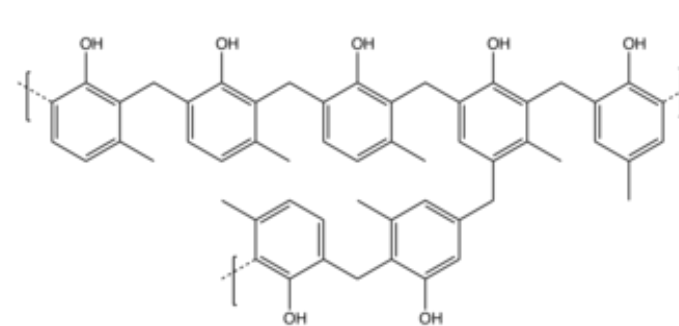
- **Bio-based / renewable Binders -- to be found out**

e.g. Lignin-derived binders?

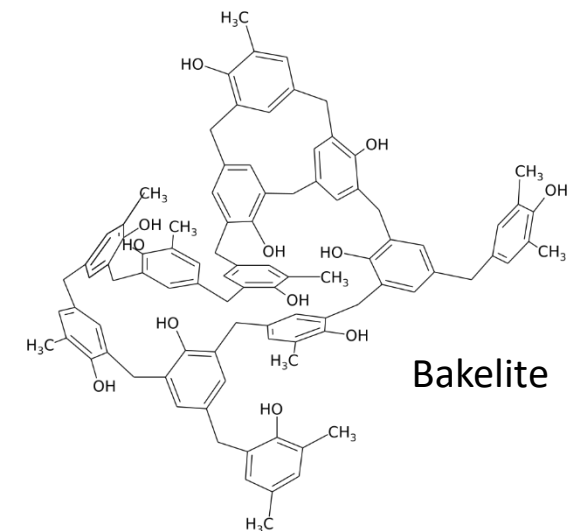
> yield amorphous carbons

> chemical modification possible?

> adaption of production processes required



crosslinked Novolak resin



Bakelite

> Let's get together!

We are a manufacturer for Carbon Products, not raw materials.

We need to rely on a stable, long-term supply.

There are possibilities and applications for new materials in the Carbon Industry.

Chicken-and-egg problem:

Existing processes new to be adapted to new materials.

Or develop new synthesis techniques to obtain classical carbon materials from biomass.

> Questions?