TECHNOLOGY LICENSING

ENGINEERING SERVICES

PLANT CONSTRUCTION

IDEAS INSIDE

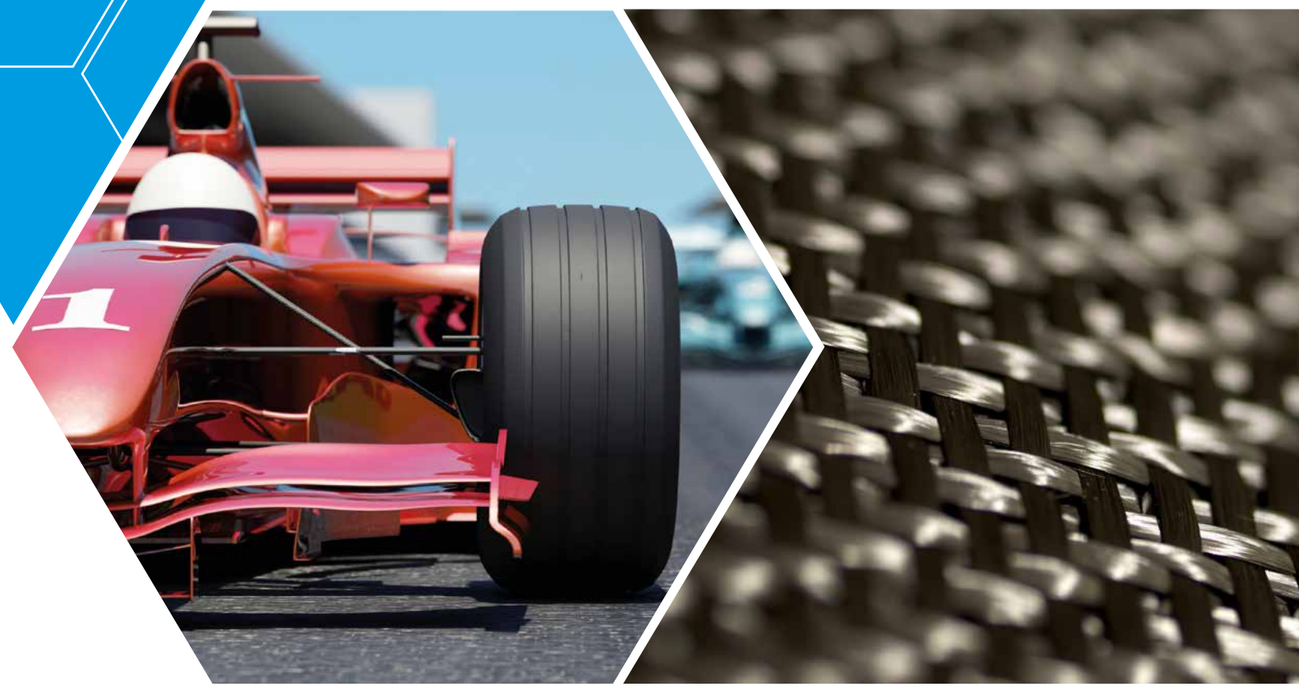
ENGINEERING & TECHNOLOGIES

Carbon Fiber Factory Design

Infrastructure | Utilities | Civil Engineering

PAN-Polymerization Plants

Polymerization | Dope Preparation | Solvent Recovery



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TÜV International Certification THÜRINGEN CERT ISO 9001 15 100 128194 TIC

MADE IN GERMANY

EPC Group is certified per DIN EN ISO 9001

A MEMBER OF EPC GROUP

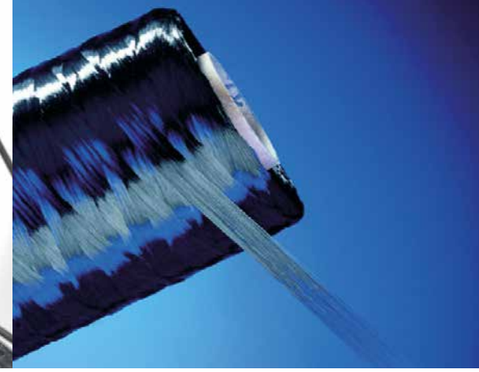
Carbon Fiber – The Strongest Among the Lightweights.

The fastest cars, the quickest jets and the bike of an Olympic Medal winner all have one thing in common: They depend on Carbon Fibers, a material that allows them maximum speed thanks to its super light weight as well as its the strong and durable texture. Our team has vast expertise in working with different chemical compounds of polymers as an initial material for carbon fibers. We know that no two plants are alike. We design and build PAN / Carbon Fiber Plants to fulfill our clients‘ individual needs and requirements.

IDEAS INSIDE







PAN and Carbon Fiber Production

Complete systems for Polyacrylonitrile precursor production and complete infrastructure for carbon fiber factories

With regard to the polymerization, two different processes are generally applied for producing a polyacrylonitrile (PAN) polymer. For the solution polymerization a solvent is used to dissolve the monomer and also to keep the polymer in a solution. However, the removal of the remaining monomer and undesired side products is complex. The monomer acrylonitrile dissolves in demineralized water, while the insoluble PAN is precipitates during the polymerization.

In a water based polymerization, a redox system is used to initiate the chain growth process. It is important to ensure the correct reaction temperature and a short polymerization time and to achieve the desired polymer properties as well as the addition of the right amount of diverse comonomers in order to avoid long- and short-chain branching side reactions. The reaction is carried out in special, multi-stage continuously stirred tank reactors designed by the EPC Group.

Since water is used as a reaction medium in the liquid phase, an environmental pollution will largely be avoided.

Since the radical polymerization never reaches full conversion, the monomers must be removed and recovered. For this purpose a suitable stripping column will be used. After the monomer removal the solid polyacrylonitrile will be separated and dried.

With the help of a subsequent continuously operating spinning solution preparation system the PAN will be dissolved in a suitable solvent. Specially designed mixers, filtration and degassing systems allow a high level of purity and homogeneity of the spinning solution. This so-called dope is then pumped at a uniform flow rate to the spinning bath of the precursor spinning system. To obtain PAN-precursor that will be used in further production processes.

The solvent-water mixture from the spinning bath and the subsequent washing and drawing baths will be sent to the solvent recovery where water and solvent will be separated from each other. The solvent and water will then be reused for the preparation of the dope and during the spinning process.

The EPC Group offers the complete planning of carbon fiber factories, including infrastructure, auxilliary facilities and civil engineering as well as the delivery of the key equipment and utilities.

EPC GROUP

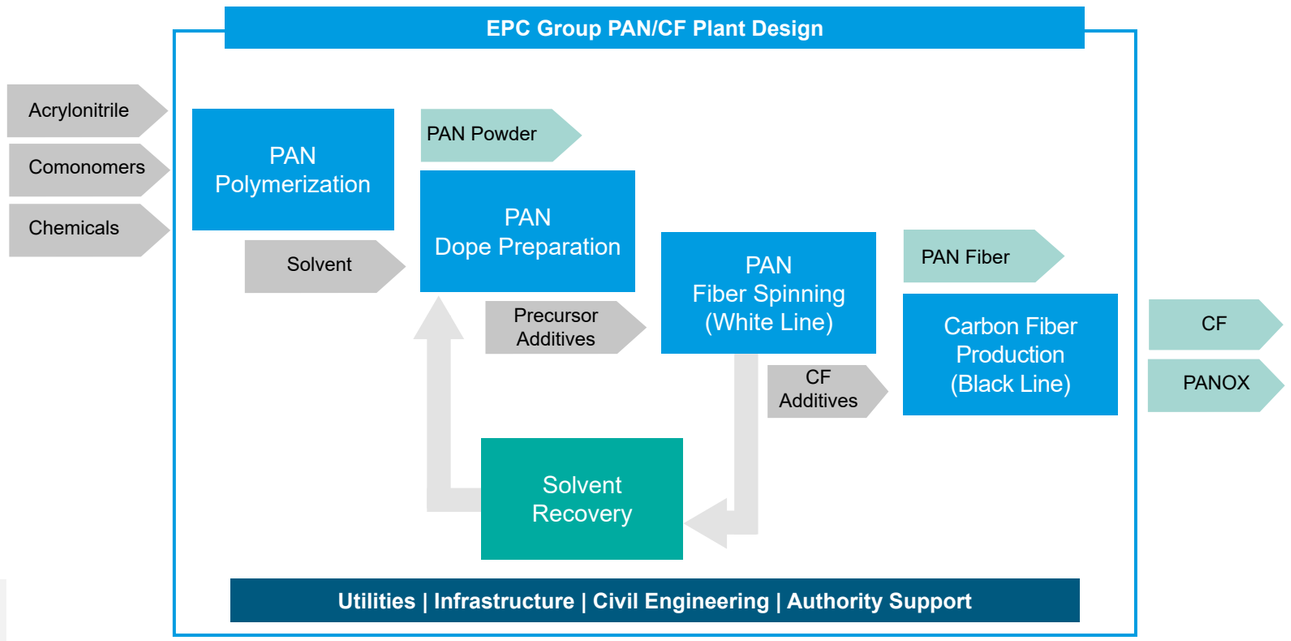
EPC ENGINEERING & TECHNOLOGIES
- Polymers & Fibers
- Chemistry & Specialty Chemistry
- Renewable Energies
- Biotechnologies
- Engineering Services & Infrastructure
- Pharmaceuticals & Fine Chemistry

CRYOTEC Anlagenbau GmbH
- Cryogenic Systems
- Systems for Compression & Liquefaction of Gases
- Small Scale LNG Systems
- Air Separation Systems
- CO_2 Technologies
- Special Applications for Technical Gases

BAUPROJEKT
- Construction Engineering
- Infrastructure
- Building & Civil Engineering
- Project Management
- Technical Building Equipment

PAN Polymerization Process Overview

EPC's Scope



PAN POLYMERIZATION
- Continuous stable process for constant PAN quality
- Lower residual monomer content in PAN
- Flexible recipes for different CF properties
- Reliable equipment, low maintenance cost

DOPE PREPARATION
- Continuous production, filtration and degassing of the spinning solution
- Environmental friendly operation and design
- Closed loop recycling of solvents

SOLVENT RECOVERY
- High purity solvents
- Energy saving design
- Different designs available for:
  - ✓ DMAC-Dimethylacetamide
  - ✓ DMF-Dimethylformamide
  - ✓ DMSO-Dimethylsulfoxide

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