

Beckhoff Embedded PC integrates all control functions into a single platform

PC-based production of carbon fiber precursors for high-performance materials

One of the areas of expertise at the research center for carbon fiber technology at Shandong University on the east coast of China is the development of solutions for scientific and technical problems related to high-performance carbon fibers, analysis and production of high-strength carbon fibers with high modulus of elasticity, and the development of carbon fiber composites. The research institute uses PC-based control technology from Beckhoff for improving process quality.

Carbon fibers are used in a wide range of applications, including wind turbines and car parts, primarily for the purpose of weight reduction.

Without carbon fibers, solutions to a wide range of technical challenges would be unachievable. Examples include large structural components in commercial aircrafts, the construction of wind turbines or hydrogen pressure vessels, and reduced fuel consumption in cars through weight reduction. Modern medical technology or the production of sports equipment is also hard to imagine without the application of carbon fiber reinforced plastic.

The most common technique for producing carbon fibers is based on polyacrylonitrile (PAN) as the raw material (precursor). The production involves several process stages, including stabilization of the precursor, carbonation, treatment of the fiber surface, application of a preparation and winding of the fiber onto reels.

As a polymer raw material, the precursor is crucial for the quality of the carbon fibers and the composites produced from them. Uniformity of the precursor

fibers is important for ensuring ideal workability of the material and for achieving the required strength of the carbon fibers. Process parameters such as temperature, pressure and speed therefore have to be controlled very precisely during production of the PAN precursor, in order to avoid problems and quality fluctuations during carbon fiber production. In view of the stringent control requirements, the research center for carbon fiber technology based in Shandong province decided to use a PC-based control system from Beckhoff in the production of high-performance PAN precursors.

Embedded PC integrates PLC, temperature control, Motion Control and HMI

As the centerpiece of the automation platform, the CX1010 Embedded PC offers high process control stability and precision. It is connected to a CP6901 Control Panel via DVI/USB. The CX handles PLC, tem-

perature control, Motion Control and HMI. The existing Ethernet interface and the Windows operating system offer convenient remote maintenance and diagnostics options and reduce the development time and maintenance costs for the whole control system. Other benefits of PC-based control include simplified commissioning and the significantly faster startup of the production control system.

In the PAN precursor plant 10 AX5000 Servo Drives are connected to a total of 19 AM3000 servomotors; additionally, the I/O is networked via EtherCAT. At the same time, the flexible expandability of the EtherCAT I/O system permits the connection of equipment from third-party suppliers via corresponding fieldbus interfaces, offering scope for simple system extensions.

Carbon Fiber Engineering Research Center of Shandong Province www.cmse.sdu.edu.cn
Beckhoff China www.beckhoff.cn