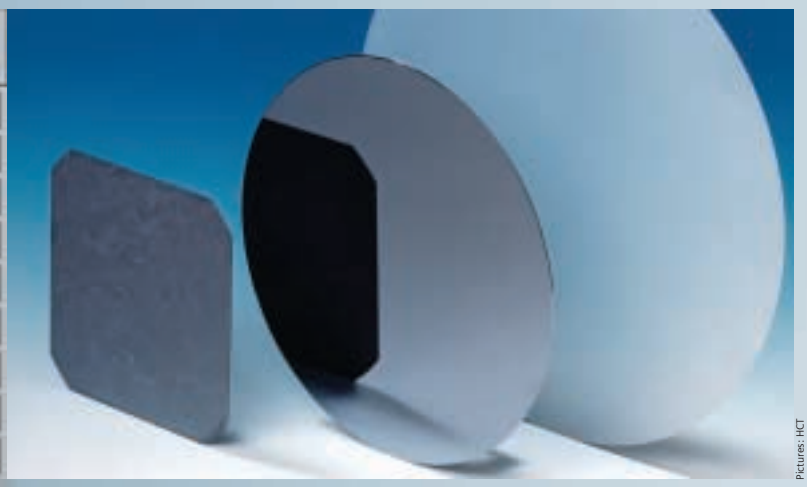
HCT Shaping Systems SA backs PC-based control for new wire saw

Incisive miracle of synchronization

Manufacturers of solar-cell wafers have to deal with strong cost pressures. Against this background, HCT Shaping Systems SA makes an important contribution to increasing the competitiveness of solar technology with its E500SD-B wire saw. The E500SD-B is extremely fast and cost effective thanks to its PC-based controller and perfect drive synchronization from Siemens.



Pictures: HCT

Precision monitoring of a precision process: the new wire saw interface

HCT introduced its technology in early 1984. Initially for use in photovoltaic areas, and later in 1986 it was also applied to semiconductor wafer processing. HCT's E500SD-B wire saw allows the simultaneous separation of four silicon ingots with a surface area of up to 150 x 150 mm and a maximum length of 2 m. It can also be used to separate glass, quartz, ceramic, or germanium.

A fine steel wire is run across four rollers with grooves arranged in a square, creating two horizontal wire webs. The wire is then guided at a maximum speed of 18 m/s from the output spool over the four rollers to the take up spool. The silicon ingots, arranged on two tables in the E500SD-B, are then lowered onto the two rotating wire webs. The wire passing first through an abrasiv chemical called "slurry" then cuts the silicon into fragile wafers thinner than 300 µm.

Innovative control concept

HCT has implemented an innovative PC-based control concept for its latest wire saw. The software is written in C++ and runs on Windows NT. "This allows us to achieve optimal flexibility with regard to the configuration while taking account any additional components," explains HCT engineering manager Alain Foretay a real time subsystem (RTSS) has been created for deterministic tasks such as synchronizing the motors and interpolating axes.

Integrated communication thanks to Drive ES

The time-critical motor drives are linked to the PC-based control level via the Profibus DP fieldbus. The combination of a distributed configuration using Simatic ET 200S I/O over Profibus has resulted in fewer machine faults, time and cost savings and optimal tool modularity.

Synchronization of the seven drives for wire management is a necessity to prevent wire breakage that would lead to ingot loss. Constant wire tension must also be maintained for cutting accuracy. A main and slave motor with Siemens Simovert Masterdrives Vector Control (VC) drive the wire guide rollers. Two smaller motors with Siemens Simovert Masterdrives VC frequency converters are used for winding/unwinding the wire spools (constant wire tension). Two motion control modules control the axis for wire positioning on the output or input spools, and one motion control module moves the two tables with the silicon ingots.

Three additional standard Siemens Micromaster inverters are involved in managing the slurry. All these converters/inverters were configured with Drive ES engineering system. In view of the fact that three different inverters are used in the E500SD-B, Drive ES was one of the requirements for integrated communication via Profibus.

Functional safety is the highest priority

A break in the wire or uncontrolled shut down of the equipment can result in total loss of the silicon and damage the wire saw itself. "We have to avoid this scenario with low-cost wafer production in mind," says Jean-Marc Rosset, head of software and hardware engineering at HCT. ■

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