Dama Technologies specializes in the manufacture of machines which are able to process glass, ceramics and other hard-brittle materials at high precision. One of the highlights of the program is the five-axis, USG 500 ultrasound-assisted grinder, in which a high-torque Lehmann EA 520.L rotary table functions as a swiveling machine table. It contains a high-speed torque axis, which was manufactured by Dama.

Dama Technologies AG, based in the Swiss town of Lömmenschwil, has filled a niche. CEO Marcel Weber tells us what’s special about his company: «We almost exclusively develop and manufacture machines for the processing of hard-brittle materials, so-called advanced materials, includ-
arranged outside of the machining chamber and thus protected against grinding sludge and dust. Linear roller guides ensure smooth, stable movement.

Depending on the application, the customer can put their ideal system together using different spindles and clamping devices, tool holders and tools (with or without a tool changer). For working with micro grinding stones an internal flushing system with pressure control is very helpful. A force measuring system with automatic feed adjustment assists in process optimization and ensures high repeat accuracy.

Dama Program Highlight: the Five Axis USG 500

The three linear axes on the USG can be supplemented by rotary axes. For example, a B-axis can be installed to swivel the head and perform four-axis machining. Dama also has a solution for five-axis machining, which is increasingly in demand: the USG 500 ultrasonic grinder.

Ultrasound Generates Defined Tool Oscillation

Dama Technologies AG, which was founded in 2001, has taken the basic technology of using ultrasound in machine tools from predecessor company Dama (Darmstadt mechanical engineering) Optikmaschinen and continued to develop it. Today, an ultrasonic generator generates oscillation in a frequency range between 20 and 45 kHz. The electrical energy is converted into mechanical motion in a transducer, and then transferred to the tool. «Not exactly an easy process chain,» noted Marcel Weber. «Whereby our new systems in which the energy is transferred inductively, i.e. no contact, are very much trouble-free and low-maintenance.»

This ultrasound system is a core element in the Dama modular grinding system, which also contains numerous other standard elements. The basis for high-precision grinding lies in a stable, low-vibration cast steel base. Normally, these machines are equipped with three linear axes, which are driven by servo motors with preloaded ball screws. They are arranged outside of the machining chamber and thus protected against grinding sludge and dust. Linear roller guides ensure smooth, stable movement.

For this model the Dama developers have integrated a standard EA 520 L rotary table from the Swiss manufacturer pl LEHMANN, Bärau into the machine (technical data: Spindle load max.: 400kg and 800kg with support / holding torque spindle clamping: 2’000Nm / pull-out torque: 3’900Nm / axial force: 100kN / feed torque max.: 440Nm / Max. spindle speed: 50 1/min). The CNC rotary table is fixed to a special support, which enables geometrically precise alignment. It serves as a fourth axis to swivel the component. «Since 2007, whenever we have needed an indexing axis, with a self-locking drive mechanism, or gear unit, we have worked with Lehmann,» says Marcel Weber. «We know from experience that in these axes maintain their precision over a long service life. We have had less positive experience with products from other suppliers.»

With the USG 500 there is another rotary axis on the Lehmann-rotary table; a direct drive built by Dama. It is also

The Lehmann rotary table provides for high geometric precision through its excellent radial and axial runout characteristics.
indexable and highly precise. As a torque-axis, it provides higher speed and lower torque than a geared motor, which is needed for the targeted grinding operations.

**Precision Through Complete Machining**

A typical example of five-axis ultrasound-assisted grinding comes from the optical industry: the so-called laser gyro's, which consists of a square block of glass-ceramic material that has precise holes on all four sides. This component is a part of positioning systems that are used in the aerospace industry, in shipbuilding and rail industries, and also in drilling rigs, where it is necessary to recognize positions or changes in position with very high precision.

But other industries such as the watch industry or medical technology also use this special five-axis machine for grinding ceramic materials. Even precise simultaneous machining is possible. According to Marcel Weber, Lehmann rotary tables and Dama torque axes complement each other perfectly in such cases. The EA-520 is the right size and provides the high torque required to swivel the mounted torque axis safely and accurately. The holding force is absolutely sufficient, since there are no high machining forces during grinding, and the reverse backlash problem during load changes is kept within such narrow limits - through the use of an optical angular position measuring system and appropriate control - that precision requirement are met. «Today, we guarantee accuracy of +/- 5 seconds, but we know that the actual figures are significantly lower,» adds Marcel Weber.

**Backlash-free Gear Unit for Precise Simultaneous Machining**

However, the Dama CEO is very excited about the recently introduced 3rd edition of Lehmann-rotary tables, which are equipped with Lehmann's newly developed PGD (preloaded gear drive). This gear unit rotary table is delivered in a defined preloaded state, which makes simultaneous machining possible, even without a direct measuring system. Dama is going to use the rotary tables with PGD at the next possible opportunity. That will not be too long in coming, since normally about five USG 500 units are produced each year.

The five-axis ultrasonic grinder is easy to use. This is due to the CNC control system from B&R Automation. Marcel Weber explains: «Although this Austrian company is more from the PLC segment, they offer CNC's with a wide range of possibilities. This enables us to provide for a work environment that includes clear and simple dialogs for drilling, boring, abrasive cutting and flat or lens grinding. This simplifies the setting and programming, so that employees can operate the machine without specific CNC knowledge. Combined with a CAM solution even complex 3D geometries can be ground.»
Special Grinding Machines from DAMA

Dama Technologies is a company from Eastern Switzerland with about 30 employees, which is involved in the development, manufacture and sale of machinery and equipment in the field of precision engineering and in the optical and ceramics industries. Their core business is ultrasound-assisted grinding machines for the processing of hard-brittle materials. Dama Technologies AG and their essential expertise date back to the former dama(Darmstadt mechanical engineering) Optikmaschinen, founded in the 50s, which was sold in in the 90s in Switzerland. Currently, there are approximately 15,000 machines from the brands Dama and Meteor installed on the market.

3rd Edition Lehmann Rotary Table Technology with PGD

The rotary table manufacturer pL Lehmann have improved their 500 series CNC rotary tables. Since January 2015, the Swiss company has offered its new 3rd edition, which is especially distinguished by its preloaded and backlash-free gear unit PGD (preloaded gear drive). There are many advantages: The defined preloaded PGD makes true simultaneous machining possible, even without a direct measuring system. In addition, smaller machining tasks up to one third of the allowable feed torque can be machined unclamped thanks to the preloaded gear unit.

Another advantage: The gear unit is wear-free to a large extent, which was confirmed in a comprehensive long-term test with the EA-510 rotary table, with standard load and drive data according to catalog. After more than 6.6 million 90° cycles during an operating time of 6800 hours no significant wear was found. Only the preload decreased by 3% per 1 million cycles.

Based on these results and additional security measures, the PGD may be expected to perform 5,000 hours under continuous operation by (Simultaneous operation with ED 100%) or 20,000 hours of positioning operation (ED 20% according to catalog) or 20 million 90° positioning without needing to adjust gear backlash (valid with standard load according to catalog. When used as intended; the first limit reached is valid).