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Everything Under Control

Trend Report. Manufacturers of measurement and testing technology are currently refining different detail functions and more accurate measurement ranges. Their focus is increasingly turning to compact high-speed measurement instruments, combined measurement and control processes and applications in surface technology.

Plastics technology is something to appreciate with all your senses: you can hear the giant machines working, and the distinctive smell of molten plastic stays in your nose. Measurement and testing, however, should be performed under conditions that are as quiet, odorless and vibration-free as possible, since every micron, every tenth of a second and every decimal place is important. The innovations and trends from this area can be summarized under the slogan "faster, more accurate and more convenient." In testing technology, apart from improved mechanical methods, optical and thermal testing of materials and surfaces are increasingly coming into focus. With such processes, the test objects must show whether they meet particular requirements or not. Quantitative measurement technology, on the other hand, relates first and foremost to a reference unit. Here, users are especially offered combinations of measurements and rules.

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High-Resolution Mechanical Testing

Standards and standardization play an important role throughout testing and measurement technology. In mechanical testing, legal changes continually lead to product extensions or innovations. For example, not so long ago the standard EN →

Fig. 1. For many companies, the automotive industry is and will remain an innovation driver. The test head for textile abrasion on plastic materials (3rd from left) was developed together with users
(figures: F. Gründel)

ISO 527 for determining the tensile properties of plastics was revised, leading **Zwick Roell AG**, Ulm, Germany, to modernize its Testcontrol II general purpose testing machine for tensile, compression and flexural testing. However laborious these adaptation processes may be for the manufacturers, however, they are a quality feature and protect the appropriate products against plagiarism or inferior equipment.

For defined mechanical scratch testing, **Erichsen GmbH & Co. KG**, Herner, Germany, offers the Scratch Hardness Tester 413 and the Lineartester 249 with a wide range of test heads. Thanks to an electrical drive, these linear testers are also suitable for long-term testing. It is not only these manufacturers who focus their development work on applications in the automotive industry. For example, a test head was developed especially for material textile abrasion testing, for example of car seats, on which the fabric is fixed flexibly instead of rigidly **(Fig. 1)**. This allows the abrasion of the test material to be simulated under realistic conditions.

The fracture of a hard test specimen by instrumented pendulum machines and drop towers is often almost invisible to the human eye. That is the function of the high-speed Ceast DAS 64K data acquisition system from Instron Deutschland GmbH, Pfungstadt, Germany. It resolves the time sequence of such a measurement to 4 MHz **(Fig. 2)**. That permits precise data acquisition, particularly for brittle materials, low-temperature tests and high-speed drop tests. The acquisition and processing software is another focus of development for many testing and measurement ranges. The issue here is to generate as much information as possible from existing methods and processes, evaluate it appropriately and archive it as efficiently as possible.

Fig. 2. High-speed data acquisition is interposed between the test instrument and computer evaluation. Here, a high measurement rate is required in events such as pendulum machines and drop towers

Optically Flawless Aesthetic Surfaces

In a market in which products are becoming more and more similar in the eyes of many consumers, aesthetic arguments can sometimes be decisive. This includes a brilliant, robust and optically flawless surface. For this purpose, **Mikroskop Technik Rathenow GmbH**, Rathenow, Germany, presents the classical light microscope, which can make multiple surface layers, inclusions or defects optically visible. Polarization contrasts or oblique incident light make the different contact angles and stresses between two or more surface layers visible.

ElektroPhysik Dr. Steingroever GmbH & Co. KG, Cologne, Germany, has also worked on such a way of characterizing different thicknesses of surface layers. The QuintSonic 7 hand measurement device does not use optical measurement, but operates acoustically using ultrasound via a coupling medium such as water. The compact device can measure up to five layers with a minimum thickness of 10 µm at once, and show them immediately in an integrated display. The instrument is particularly in demand for rapid measurements in the automotive or aircraft industry, if many different layers have to be applied to a part.

Krüss GmbH, Hamburg, Germany, offers systems for contact angle measurement. One droplet of about 50 trillionths of a liter of liquid is dispensed onto the surface to be tested **(Fig. 3)**. High-resolution cameras with 61, 311 or 3,900 images per second then enlarge the behavior of the droplet so that they can determine the contact angle. Despite the complex construction of this test method, a hand device for rapid practical measurement was launched on the market.

An enhancement by **Werth Messtechnik GmbH**, Giessen, Germany, is based on the already patented WFP/S fiber probe for coordinate instruments for contour determination. Thanks to the improved signal processing and 64-bit control tech-

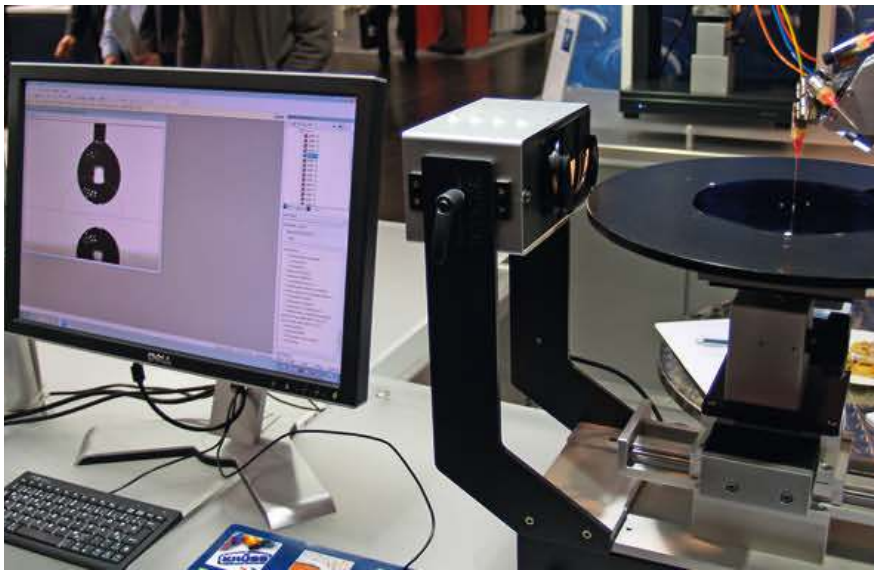

Fig. 3. For contact angle measurement, a precisely metered droplet is applied in a defined way to a surface (right), observed with high-resolution cameras (center) and evaluated on the computer (left)

nology, the microprobe can now measure in a controlled scanning operation without predefined contours. After the user has specified a start and end point for the web to be scanned, the sensor automatically follows the unknown contour. The contact forces on the workpieces are of the order of µN; operation is by probe sphere and strongly enlarged camera optics. With this automation, the developers set their sights particularly on contour measurements on surgical implants, miniature gear wheels or in automotive technology, for example in fuel injection systems.

The Purity Scanner from **Sikora AG**, Bremen, Germany, too, operates optically, but also with X-rays (see page 32). It separates contaminated granules or pellets, and is used for checking the quality of recyclate. Because of the X-ray technology, not only external soiling but also contaminants from 50 µm included in pellets can be identified. The pellets are separated at a throughput of 500 kg/h. Material that is as pure as possible is an important quality characteristic in many manufacturing processes, particularly in the course of the evaluation of recycled materials.

Automating Thermal Testing

Since the samples for thermal analysis are very small and must be accurately prepared, the manufacturers of such test devices present highly automated complete solutions. That is the purpose of the 360° concept of the **Netzsch-Gerätebau GmbH**, Selb, Germany, based on the DSC 214 Polyma differential scanning calorimeter **(Fig. 4)**. The user is offered an overall package of hardware and software solutions from sample preparation, through measurement, to evaluation and archiving of the test data. The DSC instrument is linked to a database that permits it, after testing, to immediately verify the corresponding material data.

Emmeram Karg Industrietechnik, Krailing, Germany, has also revised its product range, in particular the melt flow index testers, to be more user friendly. The Melt-Flow series can now be intuitively operated via a tablet computer with a 7" multitouch screen directly at the instrument. As with smartphones or other mobile devices, users no longer want to read a user manual before they start testing. The test results are shown immediately on the display. Such stand-alone instruments are available from a number of manufacturers. Tablets with software, or apps, are often to be found on the instruments, which are used both to start and stop the test, and to display and edit the results.

Combining Measurement and Control

In the field of measurement technology, there are many signals favoring process combinations. With Mold Drive, **Hummel AG**, Denzlingen, Germany, presents a motor actuated hot-runner controller that both measures the temperature and regulates the servo drives of the mold. That not only reduces the operating complexity but also saves the user the trouble of another ancillary device for electrically driven functions.

A combined measuring and control technology that has long been used in hot-runner technology is now offered by **Priamus System Technologies GmbH**, Salach, Germany, for cold-runner applications, too. The Fillcontrol automatic shut-off nozzle control automatically recognizes a melt front with the aid of cavity pressure →

Fig. 4. Samples prepared for differential scanning calorimetry. The pellets must be manually disintegrated previously, filled into crucibles and placed on the instrument. From then on, the measurement runs fully automatically

and cavity temperature sensors, and delays the opening of individual shut-off nozzles until the cavity is uniformly filled. The control is for either the average filling time or for a desired setpoint filling time.

Although not combined in one machine, the range of color measurement instruments based on the MA38 probe head adapter has been expanded by **ColorLite GmbH**, Katlenburg-Lindau, Germany. It allows inhomogeneous samples, such as plastic flakes or recycled pellets, to be scanned over a wide range, and their color purity and quality ascertained. With the adapter, the test area can be scaled up to a diameter of 38 mm. The color data of the solids can then be investigated with spectrophotometers. Accurate, maximum color precision then plays an important role, including for the aforementioned product aesthetics, and therefore for the user. Such measurement instruments also contribute to ensuring uniform quality for sustainable products with a high recyclate content.

Faster, More Precise, More Convenient

The innovations in the field of measurement and testing technology are to be found in the balancing act between market demands, legal requirements and technical feasibility. In summary, it can be stated that existing equipment has been enhanced with more advanced functions, processes have been suitably combined and the hardware and software have been ergonomically upgraded. A wider field of application here is surface technology, which particularly focuses on the automotive industry. The instruments also reflect trends that take the plastics industry beyond measurement and testing technology, such as sustainable products through sophisticated recycling technology. Measurement technology remains a highly scientific field. Many methods have already been very highly refined, and new developments have been made always at the limit of what is possible. Small development steps can often be observed, on which work is progressing no less intensively and strenuously in order to be able to present innovations in the coming years, too. ■

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