

# Diagram 146

Customer magazine of the Buhler Group

**Focus:** Grinding & Dispersion

## Broad basis

**The Buhler Grinding & Dispersion business unit has undergone sweeping changes over the past few years in an ever-new environment. Novel fields of application such as ultrafine coating materials, paints, or cosmetics have been added to the traditional areas of printing inks and chemicals.**

The manufacture of printing inks by grinding and dispersion of pigments is closely related to the production of chocolate. The quality of both products increases with the quality and intensity with which the raw materials are mixed and ground. It is therefore not surprising that the origins of the current Buhler Grinding & Dispersion business unit are found in chocolate production equipment.

### **Independence gained in 1992**

Until the early nineties, chocolate and printing ink & paint customers were looked after by the same business unit. When offset printing took off, the printing inks business of Buhler also started to boom. Business was no longer limited to the sale of single machines, but was extended to include complete plants for the production of printing inks. The logical step in 1992 was to create a separate business unit for the inks, paints, and chemicals plant business as part of the corporate reorganization at that time. With a global payroll of roughly 120 and sales (turnover) of about 78 million Swiss francs (2006), the Grinding & Dispersion business unit (GD) has now established itself in the middle of the Buhler group in terms of size.

### **Changing markets**

Over the past 15 years, the market of the GD business unit has undergone pronounced changes. On the one hand, the number of printing ink manufacturers has diminished to just a few market players. On the other hand, the emergence of new printing processes has greatly broadened the product range of printing applications. To meet the increasing demand for installations for making liquid printing inks, Buhler acquired the wet grinding and dispersion technology activities of the German Drais-Werke company in Mannheim in June 2003. In addition, the development of new processes was intensified in order to enter new market segments.

### **Broad range of products**

Today, the Buhler GD business unit stands on a broad basis. "We specialize in developing complete solutions, systems, and production plants allowing high-grade reaction products such as pigments and expensive component



Markus Hofer, head of the Grinding & Dispersion business unit.

### **Markus Hofer**

Markus Hofer was born in 1960 and grew up in Solothurn, a mid-size town located between Zurich and Bern. He graduated in mechanical engineering from the Swiss Federal Institute of Technology (ETH) in Zurich. During his activity with CERN in Geneva, Hofer obtained his doctorate in the natural sciences. After serving for two years as head assistant at the ETH in Zurich, he worked for five years for Balzers AG. In 1995, Markus Hofer joined the Buhler Specialty Foods business unit as a development engineer. After building new product platforms and streamlining the Specialty Foods activities, he took charge in 1999 of the Extrusion Systems business unit. Since April 2006, Markus Hofer has headed the Grinding & Dispersion business unit. (bos)



Inside the Grinding & Dispersion research laboratory (right to left): Bernhard Stalder (product manager), Markus Hofer (head of business unit), Olaf Eichstädt (head of design development), and Pradeep H. M. (project supporter at Buhler in India, current in Uzwil for training).

substances to be dispersed very finely and very uniformly throughout various carrier substances,” says Markus Hofer. Hofer has headed the Grinding & Dispersion business unit since April 2006.

With this broad range of products, Buhler has ceased to supply machinery and processing installations merely to the printing inks and paints industry. In its capacity as the market leader, the GD business unit is now also setting new standards in the electronics industry and in cosmetics applications. Today, Buhler plant and equipment produces more than just printing inks and paints for the world's markets. It is also used for making electronic inks, active substances for foods, pharmaceuticals, cosmetics, and functional coatings for – say – the shipbuilding, aerospace, and automotive industries.

#### Functional units

With the expansion of business activities to additional fields, the traditional organization of the business unit became obsolete. Markus Hofer: “Step by step, we have built a new, market-oriented organization.” The new structure is based on two basic ideas. On the one hand, the global sales and service organizations are to receive the best possible support from the bases in Uzwil in Switzerland and Viernheim in Germany.

On the other hand, permanent teams are being replaced by project teams. These functional units are created on a case-by-case basis, made up of specialists who are members of one of the three basic functions – sales, project

#### Pigments

Pigments are coloring agents in the form of powders or platelets which – unlike dyes – cannot be dissolved in the medium surrounding them (for example the vehicle in printing inks). Pigments may be encountered in nature or they can be man-made. In the synthetic manufacture of pigments, particles are first obtained with a size of about 10 to 80 nanometers. In the course of further processing, they agglomerate and aggregate into larger particles that may be as large as a few millimeters or even centimeters. As the visual effect (tinting strength) of pigments will increase to a certain limiting diameter as the particle size decreases, the agglomerates and aggregates must normally be reduced. For ink and paint applications, the pigments are reduced to a size of about 0.3 to 10 microns. (stb)

handling, or customer service. These project teams are headed by area managers who are in charge of the activities in a given geographical region.

#### Increasingly specialized

The age of universal production plants appears to have gone forever. Markus Hofer observes a trend toward customized processing systems. “The applications are becoming increasingly sophisticated and the differences between products ever-wider. As a result, the specialization of the related plants is also continuously increasing.” Together with the expansion of the business fields, this increases the flexibility and delivery time requirements for the GD business unit. Thus, Markus Hofer's team supplied over 400 mostly tailor-made systems to customers last year.

What has also changed is the share of sales by market segments: Today, paints and printing inks account for a mere 40 percent of total sales. The share of coating materials is already at 40 percent, and that of active substances and specialties 20 percent.

#### Growth in Asia

Not only the internal organization of the Buhler GD business unit is being adjusted to the changed market conditions. “We are also busy adjusting our local organizations,” says Markus Hofer. As a result of the changes that have taken place over the past years, Hofer's business unit now generates over 50 percent of total sales revenues in Asia, one third in Europe, and the balance in America.

“We do our main business in the highly industrialized countries,” says Markus Hofer. As a logical result, he is strengthening the local bases in Japan, Singapore, and North America beside the centers in Uzwil and Viernheim. But Markus Hofer has identified China and India as the markets promising the greatest potential for growth for his business unit. “These two countries are becoming increasingly significant in the manufacture of chemical reaction products and active substances, including especially pigments. It is foreseeable that these products will also be upgraded there.” And experience teaches that Buhler equipment and processes are excellently suited for the high-quality upgrading of such materials. (bos) ■

## Increasingly colorful, thinner, and finer

**Inks and paints are not only used for printing or decorating. In many cases, they also serve protective purposes.**

**Within the Grinding & Dispersing Technologies business unit, the Coatings segment is concerned with the design and construction of complete production systems for all coatings products.**

“The word ‘coatings’ refers to a very broad range of applications for inks and paints.” Marc Degrevé is a coatings specialist at Buhler. “On the one hand, the various coatings protect metal against corrosion; wood against attack from molds, fungi, and UV radiation; and cars against the consequences of falling rocks. On concrete, they are applied for sealing purposes and for retarding fires. In addition, coatings also have an esthetic function, in particular on cars, but also on building facades, interior finishing work of buildings, metal machine housings, plastic components such as cell phone cases, and beverage cans.”

### Primer and top coat

The different applications place high demands on the products used, and these demands are rising continuously. Marc Degrevé: “When we talk about coatings, we distinguish between primers and top coats. The purpose of primers is to make surfaces smooth, to protect them against corrosion, and to improve the adherence of the top coat.” The main functions of the top coat are esthetics and surface protection. “The primer and the top coat together must be formable and scratch-resistant,” says Degrevé. “Some components are only processed into end products after coating, for example coil coatings.”

### Additional properties

The users of coating products are asking for ever-new properties. “As a general rule, coatings are becoming increasingly colorful, thin, and fine,” says Marc Degrevé. “In addition, they are being continuously provided with new or improved properties.” For example, the market today demands characteristics such as UV resistance, water repellency, scratch resistance, changing colors as a function of the viewing angle or temperature, high gloss, and many more.

The Buhler Grinding & Dispersion business unit plays an important role in the development of new applications and properties. Marc Degrevé: “We supply not only complete, fully automated processing lines for the production of all coating products. We also search together with our customers for ever-new possibilities for products and processes.”

### For the upper market segment

The heart of a coatings manufacturing system is the high-speed mixers for predispersion and the bead mills with spherical grinding media ranging in size from 3 millimeters to 30 microns. Bead mills produce the required dispersion degree in a wet grinding process.

The Buhler Grinding & Dispersion business unit primarily supplies systems for manufacturing high-end, demanding products. Customers include international car-makers (original equipment manufacturers and producers of repair paints) and makers of paint concentrates, aircraft paints, and industrial and protective paints. (bos) ■



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View inside a bead mill.



## No color – no life!

**The German company Epple Druckfarben AG is an acknowledged global leader in the manufacture of offset printing inks. Based in Augsburg, this ink specialist has repeatedly come up with new formulations. Rudolf Epple, a graduate chemist, has substantially influenced ongoing developments and improvements in printing ink manufacture over the past 50 years. He is an unsurpassed expert when it comes to knowledge of the complex interactions between printing quality and printing ink.**

**Mr. Epple, for non-specialists, red is simply red, blue is blue, and any other given simply that color and nothing else. But not for you, we suppose?**

*Rudolf Epple:* Right. For me, it is not important to distinguish between red or blue or green. Printing ink and paint manufacturers differentiate especially in terms of specific applications. Generally speaking, we make a distinction between decorative paints, industrial paints, building protection paints, and printing inks.

**As a graduate chemist and general manager of the Epple printing inks factory, your focus has been especially on the production of printing inks. Do any differences exist in this area, too?**

*Rudolf Epple:* Yes, and they are even very marked. At least ten different ink types exist. Their formulations are a function of the printing process for which they have been developed. Thus, very different types of ink are applied in flexographic printing, offset printing, and gravure printing. All inks contain resins dissolved in solvents as a vehicle or binding agent. For gravure printing, toluene is the most widely used solvent. The solvents applied in flexographic printing include, among others, alcohols, ester, and water. Offset inks, on the other hand, are based on oil – a large number of different oils are used as solvent.

**What printing processes do we encounter in our everyday lives when we read printed matter such as magazines, newspapers, and brochures?**

*Rudolf Epple:* In our everyday lives, offset printing plays an important role. Beside flexographic printing, it is used for virtually all mass-printed products. When very high runs are involved, for instance illustrated newspapers and

### **Epple Druckfarben AG**

The origins of the current company Epple Druckfarben AG date back to the Otto Baer printing inks factory established in Radebeul near Dresden in 1889. The bear (Baer means bear in German) in the logo still commemorates the founder. In 1914, Carl Epple took charge of the company as managing director. In 1920, a second factory was set up in Dresden: Carl Epple Farbenfabrik. Both companies were successful. After World War II, Carl Epple was dispossessed by the Allies. In 1949, he founded the “new” Carl Epple printing inks factory in Neusäss near Augsburg. The bear was retained as the heraldic animal. Carl Epple died in 1952, and Rudolf Epple and Karla Berz took charge of the business. The establishment of a company in Switzerland in 1972 strengthened exports. Today, Epple exports about 40 percent of its annual output of 8000 metric tons of printing inks. In 2001, the company was transformed into a family-owned stock company. Since 2002, Epple Druckfarben AG in Augsburg has been headed by the trio Joachim Erlach (sales), Dr. Klaus-Dieter Schröter (engineering), and Edgar Buck (finance). (bos)

magazines, gravure printing is also applied. This is because it allows very high-contrast printing and because the prepress costs are lower with high runs. Moreover, the solvent used in this process can be recycled.

**What characterizes offset printing?**

*Rudolf Epple:* The principle is straightforward. The printing plate has image-carrying areas that are water-repellent and others that can readily be wetted with water. At the water-repellent points, the printing ink will continue to adhere when the plate is inked up. When the cylinder rotates, the ink is transferred from the plate to the blanket and from there to the paper. At the points where the water remains on the printing plate after wetting, the ink will be repelled and nothing will be printed on the paper. Offset printing superseded letterpress printing in the seventies in job as well as in newspaper printing and is now the prevailing printing process.

**Printing ink is not simply printing ink. Significant quality variations exist. What is the secret behind a good printing ink?**

*Rudolf Epple:* It is the people in the printing shop who judge whether an ink has a good quality or not. A high-quality printing ink is one which will ensure trouble-free production in the printing shop even at high printing speeds.

**What factors influence “trouble-free production”?**

*Rudolf Epple:* One important requirement is that when the ink is conveyed from the ink tank via the inking system to the paper, no deposits are allowed to be created anywhere along this path. They would otherwise have to be tediously removed again by hand. In addition, in multicolor printing, the setting or penetration of the ink is crucial. The inks must be rapidly absorbed by the paper. This will prevent fresh ink from being transferred by the weight of the paper sheets from the front of a still moist printed page to the back of the next sheet following at high speed. In this case, minutes will make the difference between high and low quality of the color. Furthermore, a high-quality ink produces crisp images, has a certain gloss, is abrasion-resistant, has a good emulsion resistance, and dries quickly on the paper but slowly inside the machine.

**That sounds highly complicated or even a little contradictory. Are you saying that good printing ink manufacturers succeed in squaring the color circle?**

*Rudolf Epple (laughing):* Yes, I suppose so, in a certain sense. The decisive factor in making high-quality printing inks is sound knowledge of the print-



**Rudolf Epple**

Rudolf Epple was born in Dresden, Germany, in 1925. He started studying chemistry in his home town and completed his studies in Bonn after World War II. As a graduate chemist, he joined his father’s company in 1949. After his father’s death, Rudolf Epple and his sister Karla Berz took charge of the company. Rudolf Epple is a widower with two sons. Dr. Carl Epple holds a PhD in chemistry and heads the laboratory unit of the Epple company. Dr. Maximilian Epple, who holds a doctorate in physics, works outside the family-owned company. Rudolf Epple, now 82, discontinued his executive activity in 2002. But as a member of the board, he still comes to the company every day. (bos)

ing process. You have to know exactly how the printing process works to manufacture high-grade inks. If you lack precise knowledge of the physical and chemical process of ink transfer during printing, you should forget about making printing inks.

**How does Epple meet all these challenges?**

*Rudolf Epple:* The secret of Epple printing inks resides in the composition of the raw materials. We operate our own printing shop for testing and finding new formulations. We also pay the utmost attention to the quality of the pigments. In many cases, the pigment manufacturer gives them a special finish, for example by coating the pigment particles with a resin emulsion. And last, not least, the quality of dispersion is also highly important.

**Do you rely on Buhler equipment for dispersion?**

*Rudolf Epple:* The dispersion process decides the printing capabilities of a printing ink. Dispersion equipment ensures optimal dispersion and wetting of the pigments throughout the vehicle – and this in the presence of particle sizes smaller than five microns. The quality of a disperser has an enormous impact on the quality of the printing ink. We have trusted Buhler dispersion systems for several decades now.

**In the last century, printing processes developed at a breathtaking clip. Have printing inks kept pace with this development?**

*Rudolf Epple:* At the start of the twentieth century, dispersion technology and ink formulations were still imperfect. In addition, offset inks did not yet exist. As offset printing emerged around the year 1920, this triggered a rapid development. Up to the year 1950, it was still difficult to print on art printing papers. Then refined resins came from the U.S. to Europe. These modified rosins or colophonium resins enabled the manufacture of offset inks that allow much faster setting and drying. In addition, special mineral oil fractions were developed in the U.S. which also had a beneficial influence on ink setting.

**And nothing has happened ever since?**

*Rudolf Epple:* But of course! In the early nineties, the first eight-color recto and verso printing machines were installed. Inks based on the specialty oils just mentioned were no longer suitable for this equipment. We at Epple then developed mineral-oil-free offset inks based on vegetable oils and in the process made a discovery which virtually all printing ink manufacturers are still imitating to this day. Vegetable oils have become the standard in current offset printing ink production.

**And how did the supplier market develop?**

*Rudolf Epple:* The techniques applied in the production of printing inks are becoming increasingly sophisticated. This requires continuous capital spending on plant and equipment. Small companies will very soon fail to keep up, which has led to a continuous global concentration process. Today, you will find a few large ink manufacturers active on a global scale. A few are mid-size producers which focus on specialty areas. Epple is one of them.

**Mr. Epple, what is your favorite color?**

*Rudolf Epple:* I do not really have any favorite color. I love all colors, for color is actually what characterizes life – no color, no life! And it is important to understand that what we call “color” is only possible thanks to the stupendous ability of the human eye to transform electromagnetic – basically colorless – waves into something we can sense: color. ■

(Interview: Herbert Bosshart)

# Sprayed, not printed

**New applications for inkjet inks are challenging ink manufacturers and therefore also the suppliers of production equipment.**

Inkjet printing is conquering ever-new fields of application. Manufacturers are outdoing each other in rolling out new and innovative products. Thus, the inkjet process is now being applied for desktop printing; for large-size printing; in industrial applications; for the colorful design of packages, tickets, labels, and markings; for applying electrical conducting paths to printed circuit boards; and for numerous other uses in the electronics industry.

As the complexity of applications increases, so do the quality requirements for the inkjet inks used. The printing heads employed for applying the ink are provided with ever-finer nozzles. As a result, a maximum particle size must be maintained to prevent the printing heads from clogging. On the other hand, the particle size distribution should be as narrow as possible to ensure or simplify stabilization of the ink. Cornel Mandler, the inkjet specialist in the Buhler Grinding & Dispersion business unit, says: "The quality of inkjet inks is increasing continuously and placing ever-new demands on the process technology applied."

This also challenges the suppliers of inkjet ink production equipment. "Buhler is more than just a supplier of plant and equipment. We understand our role as being partners in developing processes for making inkjet inks. This covers everything from providing advice on the selection of the most suitable equipment, putting the production lines into operation, fine-tuning the dispersion process, training the customer's staff, and maintaining the plant and equipment," says Cornel Mandler of the unit's new role. "We offer our customers the opportunity to develop processes tailored to their specific products together with us. For this purpose, we have an engineering lab and an analytical lab available at our headquarters in Uzwil."

Buhler possesses the process expertise for making inkjet inks as well as the experience required for manufacturing fully automated production lines. "Our new bead mills for wet grinding are excellently suited for the special requirements involved," says Mandler, referring to types ZR 120, the Superflow platform, and the latest Buhler development, the MicroMedia. The MicroMedia bead mill allows the application of tiny grinding media with sizes of 50 microns and less. Together with the high recirculation throughputs, this results in an end product with extremely fine particle sizes (smaller than 100 nanometers) and a narrow particle size distribution. (bos) ■



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## Inkjet printing

Unlike traditional printing processes, ink is sprayed through nozzles onto the substrate in the inkjet process. The inks may be water-, solvent-, or UV-based. Printing is possible on materials (substrates) of all kinds, for example paper, cardboard, textiles, plastic film, and others. For outdoor applications, the printed products are additionally provided with a protective coating. (bos)

Poster, printed on an inkjet plotter.

*mystical colors*

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