TECHNICAL BULLETIN
SUMMARY FAIR K-2013

1 INTRODUCTION

Between October 16 and 23, 2013, the 18th edition of the K Fair (triennial) was held at Messe Düsseldorf, Germany. With more than 3,000 exhibitors from 56 countries, the K is ratified as the main world trade event in the area of plastics; is the meeting point for innovation, information, interaction and investment in the plastics and rubber industry.

The Great Fair Complex located in Messe Düsseldorf has 19 pavilions that cover 168,000 m² of exhibition surface (several of them shown in Figure 1) and that can be considered a small city, since there are many restaurants, both internal and external, there is service of buses within the fair complex, a small hardware store, book and souvenir sales, rest places, emergency medical services and even a hairdresser.

Figure 1. Halls 9 to 12 of the Messe.

Several dozen fairs from various industries and sectors are held annually, being one of the commercial engines of this town in western Germany. It is estimated that some 218,000 visitors from all over the world entered the fair, close to the 220,000 visitors from 109 countries that K 2010 had. In 2013 there were 3,354 exhibitors (compared to 3,094 in 2010), from 59 countries (56 in 2010). This indicates that it is a global fair, although there is a majority presence of European companies among the exhibitors (68%, see Figure 2). In 2010, 57% of visitors were foreigners.

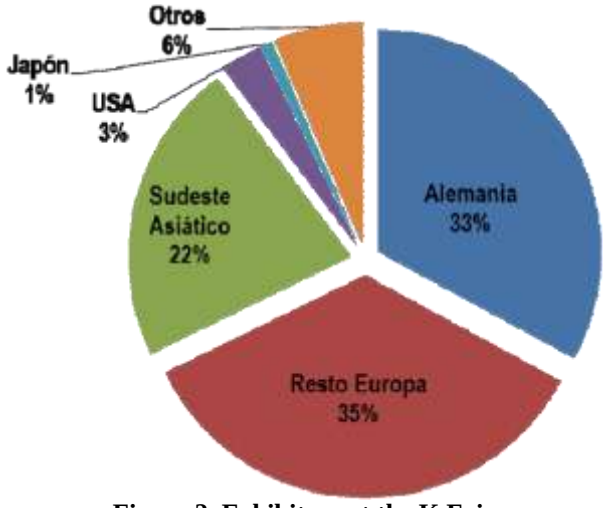

Figure 2. Exhibitors at the K Fair

The motto of the fair was "K makes the difference", and the main focus of the companies was on sustainability and energy saving. Most of the innovations and improvements presented sought to reduce waste, energy consumption in the production process, the weight of molds and parts, and consequently the environmental impact. Many European companies highlighted their association with the "Blue Competence" initiative, sponsored by VDMA, a German consortium of more than 3,100 SMEs. This initiative seeks to create sustainable companies with minimal environmental impact.

2 RAW MATERIALS.

2.1 Resins.

Braskem explained how important it is for them to reduce the environmental impact of using their polyolefins. Attempts to ban the use of plastic bags in Brazil have not been successful; the food producer is responsible for the correct use of the packaging in which the food is stored. Braskem's current capacity is 3 million metric tons per year (MMMTA) of PE, 2 MMTMA of PP (of which it exports up to 30%) and 1.2 MMTMA of PVC, but Brazil imports the latter item; they also present limitations in the supply of PELBD octenes.

Figure 3. Braskem stand

Borealis, Borouge and **Nova** were amalgamated into a single group of resin producers under the name of IPIC, with a reach in Europe, North America and the Middle East, with a production capacity of 10 MMTMA of PE and PP, which makes it a major player in the petrochemical business with global reach.

2.1 Additives.

In the flame retardant market there was a wide variety of product offerings. **FRX Polymers, Nabaltec, Richkem** and **MPI Chemie** offer a variety of non-halogenated, phosphate and nitrogen based flame retardant additives.

Omya showed its new type of calcium carbonate Hidrocarb XP, which is being used for improvements in flat and tubular films without affecting the optical properties. **Reverté** is a Spanish company that produces a variety of calcium carbonates for the plastic sector with a production capacity of 1 MMTMA. They produce calcium carbonate from calcite or white marble. Its products are offered not as fillers, but as property enhancers (impact and seal), without excessively affecting the optical properties.

Fine Organics produces specialty additives and processing aids for plastics represented by families of antiblockers, antioxidants, slip agents, antistatics, dispersants, etc. that can be optimized based on the needs of your customers. **Ferro** was present with its variety of products, including the Innovex masterbatch, which improves the mechanical and thermal performance of foamed polyethylene**. Cabot** presented the Vulcan XC max, like a cash antistatic because it is superconductive, made from carbon black. It has applications in the manufacture of gasoline tanks, cables and where a good permanent antistatic protection is required.

Among the novel proposals, there is that of **Aksoy Plastik**, which developed a compound based on organic phase change materials (PCM), applied in film extrusion, designed to store and release large amounts of latent heat when they are subjected to changes. Of temperature. The product is recommended to be used as the central layer in a multilayer structure, and is designed so that the release of this heat is done at a certain temperature and in this way, frozen foods can be kept longer outside the refrigerator at temperatures that preserve product quality.

3 FLAT AND TUBULAR FILM EXTRUSION.

Windmöller & Hölscher showed its widely publicized E24 project before the fair. These are multilayer extruders where all the elements that give off heat (feeding systems, extruders, adapters, heads) are covered with insulation with a special material, based on carbon fiber; the head is on the floor, equally insulated. In particular, they showed a 3-layer co-extrusion line, operating at 1000 Kg/hr (which includes the possibility of converting the winding train into an MD or MDO line), without the heat emitted from heads and extruders being lost. felt. The energy saving due to this insulation is 20%, according to W&H estimates. Additionally, the equipment management software has a "quick purge" option that facilitates product transitions. They highlight a significant recovery in sales, after a couple of years of low shipments.

A 500 mm diameter 9-layer extruder was observed manufacturing 7-layer thermoformed packaging sealing film at 720 Kg/hr, 55 µm thick and 2600 mm effective width. Other equipment on display was a 9-layer, 5-extruder co-extruder with a feedblock from Cloeren, called a "nanolayer" that converts two of the layers in 33 different layers, which

allows maximizing barrier performance with minimal EVOH or PA content. In this case, for demonstration purposes, the five extruders were processing an mPELBD, at 1600 Kg/hr and 2000 mm wide (thickness not reported). The most outstanding piece of equipment was a machine to produce stretch film, made entirely of PE, at 1500 Kg/hr and 3800 mm wide (effective 3000 mm, 6 coils of 500 mm each due to neck-in effects), with 12 µm in 7 extruders and up to 38 layers, thanks to the use of Cloeren nano-feedblocks.

Figure 4. W&H cast line.

Macchi presented a 5-layer extrusion equipment at 1300 Kg/hr (with LDPE+LLPE). The main attractions they sponsor (which are common to other manufacturers), is the use of direct drives, which eliminate the use of belts or gearboxes (but which can be more difficult to repair and maintain) and the possibility of adjust the location of the cooling ring on the vertical axis, which allows variable film widths (approximately 15% variation) to be obtained, with very little impact on film properties. These direct drives are also used to drive rolls on the winder. To make the equipment more compact, the chiller and the control computer are located on the second floor of the structure, freeing up space on the operating floor.

The recommendation for the basic coextrusion equipment is a 5-layer machine, since it allows the development of applications from industrial bags, through conventional FFS applications to medium barrier packaging (taking into account that each application requires different machine considerations); this makes it possible to cover an important fraction of the packaging market. The teams are easily scalable to 7 and 9 layers. The refile of the film is taken to a cutter, to feed an extruder that granulates and feeds a dispenser of the same system, making the recovery online, which allows a clean work area and the reprocessing of the film with minimal contamination.

Reifenhäuser-Kiefel did not present equipment in operation. Its stand was limited to presenting the prototype of the extruder of the year 2020, which includes or will include the following improvements: "blue" screw (aligned with the Blue Competence initiative), which will operate at 20°C less than a conventional screw and with a 25% less energy consumption (design not shown), energy recovery system used to pre-heat the resin, extruder control touch screen integrated on the direct motor, and renewed design of the feeding area. Like W&H, the extruder would be encased in an insulating material to save energy and give it a futuristic look. The rest of the stand showed prototypes of several of its 1:8 scale flat and tubular extrusion lines and a laboratory 5-layer extrusion line.

Macro has concentrated its innovation efforts on the heads and on its double bubble equipment, where they consider they have technological advantages. The year 2013 has been one of recovery and they estimate that the industry will have significant growth in 2104. The Latin American market continues to be one of their priorities. **Dolci** emphasized the thickness control capacity of its equipment, both blown and cast. As an example, kept their blown tube equipment at 2.5% variance manufacturing 50 µm FFS packing at 820 Kg/hr. Like other manufacturers, the cooling ring is mobile, in order to modify the width while maintaining the BUR. Its winders can change from torque control to surface or blended control in the process, to ensure a coil of uniform tension**. Mamata** explained the advantages of having a 7-layer line instead of a 5-layer line for a company that wants to start manufacturing multi-layer structures. His argument is based on the fact that differences in

price (which in their case are practically nil) are more than compensated by the possibility of accessing market niches and developing very low-thickness structures, which 5-layer equipment cannot have.

SML showed a flat film line producing a 7-layer structure for stretch packaging (called "super-stretch") of mPELBD and PEUBD, 12 µm thick, at 2750 Kg/hr and a winding speed of 750 m/min . The orientation achieved in said film makes it possible to achieve an MD tear strength of 15 g/µm. The film scrap was fed to an Erema extruder (Interosa 1108T), which returned the product to the pelletized system. **Hosokawa-Alpine** presented a line of 5 layers of tubular film, where they presented their X-type head, with a patented design to guarantee flow uniformity, minimum purge times and material changes. The design of the nozzle is based on the rheology of the materials to be used in each layer, which allows, in addition to the above, to achieve maximum flexibility in the use of material. Numerous samples of multilayer structures for packaging milk, perishable products, stretch-hood and others were available to visitors at this stand as a sign of the versatility of its equipment..

Double and triple bubble sets were not observed (with the notable exception of **Kuhne**), however several manufacturers indicated their ability to make them. This suggests that this technology is still relatively incipient, or that its market share does not yet justify the investment in this type of event. **Although only Reifenhäuser and W&H** presented extruder and head insulation systems with elements based on carbon fibers, it was possible to observe in other extruder manufacturers the use of flexible insulation for the same purpose (lower insulation efficiency, but lower cost), which which seems to indicate a trend in equipment design.

Lastly, measurement and control elements based on radioactive components are disappearing in favor of infrared and X-rays. The latter are capable of adequately controlling product thicknesses pigmented, which was his greatest weakness. Apparently, restrictions on the use of radioactive elements in many countries encouraged this development.

4 INJECTION.

4.1 Injection equipment.

In injection, the use of robots predominated for demoulding, assembly and expulsion of the piece; as well as for the placement of metal inserts, in quality control checks and in the use of in-mold labeling (IML), where companies not only competed for molding speed (3-4 s in cap injection), but also for the printing quality of their labels.

Major companies offering robotics technology included: **Wittman, Kuka Robotics, Hahn Automation**, and **Kiki Ingenieurgesellschaft**. In these cases, the demonstrations sought to show the speed and precision of robotic systems for the assembly of parts, extraction of parts from the mold, placement of inserts, etc. as shown in Figure 6).

Figure 5. Boy company's use of robotics and online printing

Figure 6. Robot functions in the injection process: demoulding, assembly, IML

A variety of injector manufacturers such as **Nestal, Haitian, Boy, Arburg, Battenfeld, Engel, Milacron, Sumitomo, Sandretto, Krauss-Maffe**i, and **Negri-Bossi** focused their presentation and offerings on automatic online dimensional control for caps and high-end parts. dimensional tolerance requirements, as well as high production speeds (1600-1800 pieces/min), where the common mold was 72 cavities. In addition, numerous suppliers presented rotary molds, co-injection, vertical closure for inserts and over-molding. The common objective is the reduction of cycle times and the automation of increasingly complex processes.

Additionally, **Engel** also presented numerous machines for making multi-component automotive parts, both manufactured by injection molding and by compression.

In the rotary mold of the **Milacron** stand, two caps were molded at the same time, of the same design but of two different colors that were ejected on opposite sides of the injection machine, they were joined in a common duct to empty into a container, taking advantage, not only the same closing force of the machine, but also the collection ducts of the molded parts (Figure 7). **Milacron** reported that its machines are fully modular and that the user can choose the type of system for the closure (electric, hydraulic, mechanical) independently of the injection unit system (hydraulic, electric, etc.).

Arburg, one of the world's leading manufacturers of injection machines, had one of the largest stands at the fair, together with Engel. It exhibited several of its highly complex injection molding machines, which included in-mold labeling and printing of personalized parts, among others.

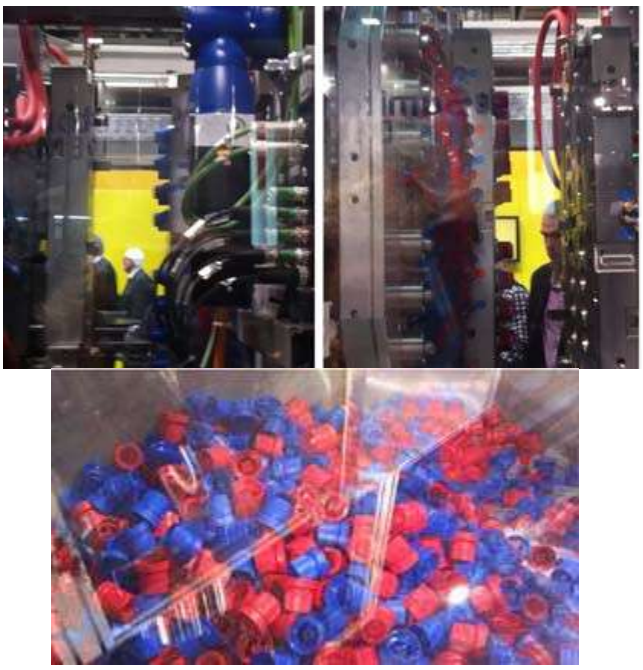

Figure 7. Rotary mold presented by Milacron for the manufacture of two-color products.

The **Babyplast Christman**n company offered injectors specially designed for micromolding, which implement the most advanced technologies of conventional molding: over-moulding, rotary moulding, vertical molding for inserts, among others. At least two companies, **Boy** and **Ravizza Packaging**, exhibited complete parts molding and automatic packaging systems on the same line, where the operator does not handle the molded parts, which is ideal for the pharmaceutical, medical supplies and food areas.

4.2 Molds.

Most of the European companies dedicated to the manufacture of molds exhibited their products in alliance with the machinery manufacturers. **Moldmaste**r introduced its **Iris** line of co-injection molds. **Man Fung Mold Industrial Co**, an ISO 9001 certified company, produces all kinds of injection moulds, including stacked or sandwich moulds, with a large number of cavities, for the gas-assisted technique and even for metal injection (MIM). **The Gefit** company not only makes molds, but also offers robotics services integrated with its services. Several companies jointly offer the service of design, manufacture and repair of molds, in various parts of the world, like **Fastnew**

Precision Plastic Steel Mold, **Kiranda Plastic Mould** and **Oriental Precise Mould**.

Heitec stands out in the supply of hot runners (hot-runner manifold), but they also offer sequential valve systems for the entrances to the cavity, nozzles, temperature controllers and other accessories for molds (horns, o-rings, sight glasses, etc.). The **AMF** company offers more than 5,000 different products of fasteners, screws and closures for molds. **The Güthle** company showed an innovative fastening system for the mold (Figure 8), which considerably reduces mold change times, by allowing the use of an auxiliary plate to assemble the mold to be used and, once assembled, this auxiliary plate slides on the mold plate.

Figure 8. Güethle fastening system

5 BLOWN

Kautex Maschinenbau exhibited a multi-cavity blower producing HDPE sports cups. The relevant innovation was a technique for changing the molds that was done in less than 5 minutes (Figure 9). At their stand they showed pieces and ducts of very intricate shapes for auto parts, machinery and in particular for the production of cylinders to store domestic gas, which can be obtained with their blowing equipment robot assisted.

Figure 9. Changes of molds (Kautex)

Techne Graham Packaging Italia showed a bottle blower with 10 cavities but it produced 20 bottles (see Figure 10) so its productivity is higher than a similar traditional machine. They also presented a fully electric blowing machine.

Figure 10. Techne blower

SMC Corporation Limited presented a coextrusion blown machine with in-mold labeling (IML, Figure 11). The supplier of the labeling is the Australian company **The Van Dyke Press**.

Figure 11. IML in container blowing

6 OTHER TRANSFORMATION PROCESSES.

In the rotational molding process there were few companies exhibiting their equipment and/or products, highlighting among them the **Persico Rotomolding** company, who showed their Smart Leonardo Technology machine that directly heats the mold with thermoresistors, creating a compact machine, without the need for ovens.

Figure 12. Persico rotational molding machine.

Pipeline equipment manufacturing companies, including **Corma, Bauku** and **Jwell** exhibited large-diameter pipe sections (see Figure 13), both smooth, corrugated and coextruded..

Figure 13. Large diameter pipe sections

7 ENVIRONMENTAL IMPACT.

An entire warehouse was dedicated to recycling equipment (both post-industrial and post-consumer), indicating the importance of this segment for the industry. **Erema** and **Wipa** indicate that the breakeven point to recover the investment in post-consumer recycling was in the possibility of processing a minimum of 10 MT/month (approximately 60 to 80 MT/month of waste of all kinds). Other companies with recycling equipment were **Ariostea** and **CFPlast**. **Plasti Sort** company offered a detection system for the automatic separation of different polymers to be used in recycling processes.

Various companies offered grinding equipment and complete plastic recycling lines, including: **Rolbatch**, **Geor-Ding Machinery**, **Sun Lung Gear Works Co**, **Weima**, **Sikoplast**, **Herlbod Meckesheim**, **Vecoplan AG** y **MBM Maschinenbau**. The latter also manufacture injectors.

8 OTHERS

M-Base is the company that bought the rights to the Campus resins database. They have created a web page with abundant information on the properties of more than 90,000 grades of resins available for free, which in some cases includes the applications and process conditions of the resins. If the user subscribes to this service, material comparisons can be made.

Aimplas is a Spanish technological institute dedicated to the investigation of plastic and related materials. The institute offers solutions in plastics in different areas: processing, formulation, design, training and laboratory tests; is very active in the field of nanotechnology and in biodegradable materials and renewable sources. Shows interest in developing alliances with centers and companies in America because they consider that there are many possibilities for collaboration in the framework of research projects.

9 SUMMARY AND CONCLUSIONS.

The K fair once again became the meeting point for the world plastic industry and the event where leading companies present their advances and innovations. The conclusions derived from this important exposition are:

- The focus of the industry is clearly pointing to the reduction of environmental impact. The vast majority of manufacturers presented innovations that represent a contribution of the company to a better environment: lower consumption of energy,

less waste generation, greater recycling capacity.

- The actual technical advances are focused on greater productivity with lower consumption. It was not uncommon to find blown film machines with flow rates greater than 1000 Kg/h, something difficult to imagine 10 years ago, or very fast injection equipment with minimal human intervention.
- The use of robotics stands out to save time in the manufacture and assembly of parts, the use of online printing (such as laser or IML) and direct packaging once the part has been molded, especially in medical and food applications.
- Manufacturers are designing equipment dedicated to specific applications.
- Resin producers focused their strategies at the fair on applications, seeking to show the advantages of their products directly in products for the final consumer.
- The issue of recycling and minimization of environmental impact is a concern of all exhibitors; a large number of companies offer equipment and services to minimize environmental impact.
- The participation of companies from the Asian region is increasing, both in number and in technical sophistication.

Finally, it is confirmed that the triennial event in Dusseldorf is necessary to know, first-hand and globally, the direction in which the plastics industry is heading. The next one is in October 2016.

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