

1 INTRODUCTION

The K 2016, held in the city of Düsseldorf, Germany, has become the world's largest trade exchange event in the plastics area, with the ratification of its status in the 19th edition, held on October 19-26, 2016, with the participation of 3,285 exhibitors (in 2013 they presented 3,354 and visitors from 59 countries) and the attendance of 230,000 visitors (70% foreigners from 160 countries).



Figure 3: Hall of Nord Entrance to Messe Düsseldorf.

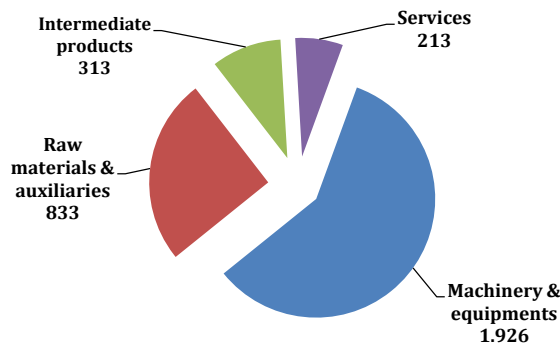


Figure 1: Distribution of sectors and No. of exhibitors.

- The Messe Düsseldorf is a large exhibition complex with 19 pavilions covering 168,000 m² of exhibition space (shown schematically in Figure 2) (www.k-online.com).

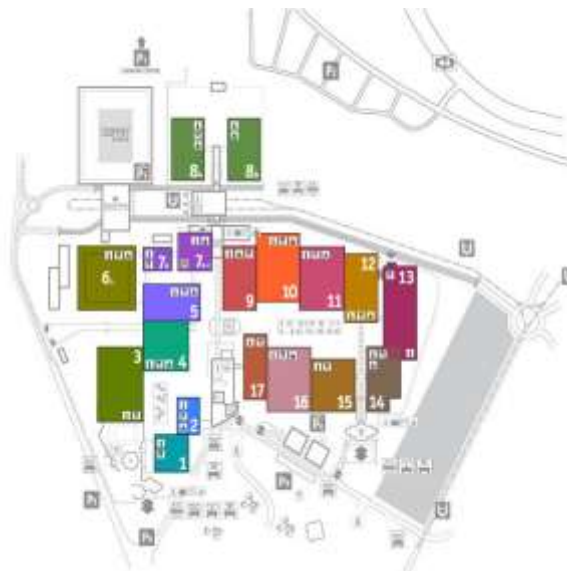


Figure 2: Pavilions of Messe Düsseldorf.

The motto of the fair was "**Industry 4.0**", a term coined by the German government to describe the intelligent factory, a vision of the computerized manufacture with all the processes interconnected by the Internet of Things (IOT, by its acronym). Energy, materials and resource efficiency were the dominant themes at K 2016, as well as innovative recycling concepts and new application areas for the manufacture of organic additives and plastics. Smart, fast and flexible production lines had high demand among attendees, where the main focus of the companies was sustainability and energy saving. Most of the innovations and improvements presented sought to reduce waste, energy consumption in the production process, weight of molds and parts and consequently the environmental impact.

The events, exhibitions and conferences organized for the fair were named as follows:

- "**Plastics shape the future**", event on a project initiated by the German plastic industry under the coordination of Plastics Europe Deutschland e.V. and Messe Düsseldorf, which highlighted the extent to which plastics shape the spaces in a functional, aesthetic and sustainable way. In this space, every day a different topic was treated with presentations, press conferences, debates, experiments and explanatory videos. In addition, groups of students of the school CJD Christophorusschule of Königswinter showed their abilities in design and robotics.



- **The Pavilion of the Science Campus:** "Dialogue between science research and business", gave visitors and exhibitors detailed information on scientific activities and discoveries in the plastic and rubber sector. Since its launch in the 2013 edition, this exhibition has grown in size and participation of universities and institutes.
- **"Design Chain @K-From design to reality"**, series of conferences organized and taught to promote innovation in plastics within the design chain, which act as a platform within the plastic industry, bringing together the names recognized in the value chain with notable designers and brands, in order to consider the global perspectives on innovation, efficiency and sustainability.
- **"Bioplastics Business Breakfasts"** event organized by the magazine "Bioplastics Magazine" for all those delegates interested in listening, talking and linking through social networks with cutting-edge topics in bioplastics.
- **"3D fab+print"** exhibition on 3D printing process or additive manufacturing that introduced state-of-the-art technologies as well as success stories in the area.

2 RAW MATERIALS AND AUXILIARIES (1).

Exhibitions were presented on raw materials, auxiliary products, semi-finished and technical parts as well as new technologies applied to plastics. The European association of polymer manufacturers *Plastics Europe* presented figures on the world production of polymers in 2015, which was 322 million tonnes, of which 270 million correspond to plastics, materials that are transformed into products, and the remaining 52 million, were used for the manufacture of coatings, adhesives, dispersions, varnishes and paints. This means that, overall, the use of plastic continues to

grow between 4 and 5% each year, despite the effects of the economic crisis.

2.1 Resins, compounds and additives.

A tour of the different pavilions of the site allowed interacting with a wide range of manufacturers and suppliers of raw material and supplies. Among the world leaders in the industry, **BASF** is recognized, - by introducing Tinuvin XT 55, developed mainly for the applications of monofilaments and polyethylene tapes and recommended for geo-textiles, insulation of ceilings, carpets, etc. It also introduced the line of brilliant green tone pigments with mica type *Lumina Royal Dragon Gold EH 0908*, which provides golden shades of high gloss to applications such as packaging, electronics, sports, appliances, among others.

In packaging film applications **BASF** developed the *Ultramid C37LC* resin which is a PA6/66 type polyamide copolymer that enables the production of heat shrinkable films that achieve greater shrinkage in air and hot water. The product avoids the formation of curling in asymmetrical multilayer films with polyethylene or polypropylene. The films produced with *Ultramid C37LC* show a low crystallinity and are therefore significantly softer and more transparent than those made with conventional polyamide. Another leading manufacturer of polyethylene resin such as **Braskem**, reported on expanding its international markets in the production of UTEC® ultra high molecular weight PE grades, with the installation of a plant in the USA. In addition, it promoted its new line of polyethylene of the plant of Mexico (Braskem-Idesa) and the green polyethylene destined to the industries of foods, cosmetics, automobiles, among others. In the area of specialized additives for polymers, **BYK Chemie** presented its new barrier additive (known as *Byko2Block-1200*) to be used in packaging made with PLA (polylactic acid) and other polymers commonly used in the packaging industry. It contains a uniform distribution of silicate plates (platelets) in the polymer matrix, which allows the generation of an effective barrier, which reduces the permeability to water vapor and gases,



allowing greater freshness to packaged foods and fruits. Also **Chemtura Organometallics**, a subsidiary of Chemtura Corporation, promoted its specialties of organometallic compounds, especially its activator *Axion MAO* (metialuminoxane), considered the most recent generation of catalytic systems for oligomerization of olefins and polymerization. These compounds are used as activators in combination with metallocenes to achieve new levels of performance. Meanwhile, **Clariant** introduced a new system based on the use of "taggant" technology, consisting of the use of inorganic compounds that are invisible under normal lighting conditions but provide fluorescence characteristics when they are excited by a laser light, allowing a single marking to be developed for a specific client or application. In the area of pigments, this company introduced the *PV Fast Yellow H4G* as an alternative to pigments based on lead chromate. Also included is *PV Fast Pink E*, based on renewable succinic acid. The company also exposed a new development in the field of non-halogenated flame retardants, based on amines for roof polyolefin sheets with high thickness, the *Addworks LXR920*.

Dow Chemical reinforced the image of its polyethylenes and related products such as *Affinity* (for films), *Engage* (for the automotive industry) and *Intune* (for films and multi-layer structures) thermoplastic elastomers. The transnational and well-known company **DuPont**, based in Switzerland, presented two commercial grades of its *Entira* line of antistatic agents (*AS MK400* and *SD100*) to be applied to PELBD blown films up to 50 microns thick, in order to reduce surface resistivity and obtain more uniform surfaces without yellowing. It can also be applied to LDPE and mPE. The renowned oil company **ExxonMobil** promoted two new grades of polyethylene: *Exceed XP* and *Enable* (grades metallocenes), developed for the lamination of packaging, stretchable films and greenhouses. **Evonik**, a German company specializing in chemicals for the plastics industry, reinforced its presence at the K Fair with its range of *Dynasylan Silfin*

products, crosslinking agents used to convert polyethylene to crosslinked polyethylene, PEX. The *Dynasylan Silfin 50* agent was developed specifically for water dispenser applications in systems operating continuously at high temperatures. Silane crosslinked polyethylene pipes are resistant to corrosion and strain deformation, while being protected from cracking.

From England, the specialist **Fine Organics Limited** promoted its special additives and processing aids for plastics represented by the families of anti-blocking agents, antioxidants, slip agents, anti-static agents, dispersants, etc. which can be optimized according to the needs of their clients. The German company **Finke GmbH** presented its pigment line for special effects and laser marking. *FibaPlast*, *FibaKeft* and *FibaComp* color concentrates allow a wide range of special effects ranging from metallic, pearlescent, rainbow and flip-flop. These additives can be combined to provide lacquered and soft touch finishes as well as fragrance formulations. *Fibaso!* is the line of fade-resistant liquid dyes that can be used with various polymers such as PE, PET and PP. In the area of stabilizing additives, **Goldstab Organics Pvt.** of India presented its range of Ba/Cd stabilizers, Ca/Zn stabilizers, lubricants, stabilizers and stearates. The international company **Hexpol TPE** specialist in the formulation and manufacture of thermoplastic elastomers, launched a new range of TPE compounds formulated to give tactile properties to the products. *Dryflex Touch* resins are designed to give a greater feeling silky and soft touch applications maneuverable devices, consumer electronics, protective covers for smartphones and tablets, ribbons for dolls, cosmetics, etc. These compounds are adherent to substrates such as PE and PP, among others. **Huntsman**, a leading international chemical group, introduced its titanium dioxide pigment *Tioxide TR48* that can be processed even at high temperatures, easy to disperse and high dye reduction capabilities, designed for the production of concentrates for polyolefins, BOPP films and compounds of engineering. Its formulation contains low

concentrations of volatile organic compounds (VOC). The French multinational company **Imerys**, presented its latest innovations in minerals for automotive plastics, plastic recycling, and odor and VOC reduction, as well as its line of additives for thermally conductive compounds. Among the products presented were: talc *HAR 3G* with high aspect ratio, was designed for the applications of PP and thermoplastic polyolefins (TPO) in the automotive industry, in order to increase stiffness, maintain impact resistance and reduce the coefficients of thermal retraction. *ImerPlast* was developed to improve the performance of recycled polyolefins from a mixture of PP and PE with a compatibilizing agent based on a mineral, allowing to incorporate more amount of recycling. *ImerSorb* is the compound designed to reduce VOC emissions and odors in home's products, office and automobiles applications. The *Timrex C* is thermal graphite for thermally conductive materials and the *Enasco* is the line of carbon blacks of high structure of high purity levels for the severe requirements of this industry.

LyondellBassell, one of the world's largest companies in plastics, chemicals and refining products, unveiled a new development of HDPE resin, with improved water vapor barrier properties (due to its increased nucleation), toughness and lower thickness when extruded with LLDPE resins.



Figure 4: Three layers co-extruded film using HDPE [taken from "Film, Sheet and Extrusion Magazine", October 2016]

Milliken Chemical, an American company specialized in clarifiers and nucleating agents, to achieve high productions and improved

properties of the final products, presented its nucleant agents *Hyperform HPN* for both PP and PE, used to improve the barrier and optical properties. As well, **Palsgaard** of Denmark introduced its line of functional additives, 100% vegetable origin, dispersing aids, anti-static agents and anti-fog agents. *Einar 101* and *Einar 102* additives were introduced as novel colorant dispersing agents for color concentrate manufacturers.

One of the leaders in adhesive compounds for coextrusion such as **Polyram Plastics** of Israel, presented its *Bondyram TL4530* and *TL 4401* products, used as adhesion layers in coextrusions of PET, PETG and PS resins with EVOH, PA and PE resins. **Solvay** from Belgium, took the opportunity to present its new line of *Cyasorb Cynergy Solutions UV* stabilizers for films, automotive and industrial applications. **Songwon** promoted its portfolio of stabilizers for polymers with antioxidants and UV stabilizers, including its range of One-Pack systems. Meanwhile, **Teknor Apex** of the United States, presented its new thermoplastic vulcanizate (TPV) *Sarlink 9156-02* specially developed for joints of pipes of low pressure and of drainage, with a low coefficient of friction by its level of lubrication, in order to facilitate the insertion of tubes in fittings and connections.



Figure 5: O-ring for Pipes manufactured with TPE Sarlink of Teknor Apex [Taken from "Compounding World" magazine –September 2016].

The German company **Wacker Chemie AG**, a leader in silicone products, additives, polymers and chemicals, introduced its line of *Genuine WPC* lubricants based on

thermoplastic silicone compounds for the manufacture of plastic wood compounds (WPC) with PE, PVC and PP. These additives act mainly as lubricants, reducing the coefficient of friction of the plastic and the internal and external friction during the extrusion. Currently there are formulations with PP (*PP20A08*) and PE (*HDPE 20A03*). In the field of liquid silicone rubber (LSR) materials, the company introduced four new products for sealing applications: *Elastosil LR3003/90* with hardness levels of 90 Shore A for the production of "hard" parts by injection molding in a combination of hard-soft LSR-type materials; *Elastosil LR3020/60* medium hardness and improved steam and water resistance developed for sealing applications; *Elastosil LR3016/65* with high resistance to oils; *Elastosil 3072/50* developed for the production of radial seals and horns for cables for the electrical and electronic sector. The company also showed its product LSR *Lumosil LR7061* developed for the production of lenses, sensors and coupling elements.

3 EQUIPMENTS, MACHINERIES AND PROCESSES ⁽²⁾.

Under the concept of "Industry 4.0", more automation was offered for quality control and lowering costs through reduced cycle time and product weight controls. There was a marked trend to improve the mechanical and barrier properties of the packages, in order to replace conventional materials such as metal. The new equipment has systems to monitor production and maintenance. The companies present at the fair and highlighted in this bulletin, showed products developed under this concept of automation in control.

3.1 Extrusion

Feddem GmbH & Co.KG of Germany, unveiled the *FED 26 MTS* pilot plant extruder which includes configurable wear improvements for different applications and the development of various composites. Designed in a modular way, it allows feeding and lateral venting by vacuum, to reach yields

of 10 to 150 kg/h. Another renowned company from Italy, **ICMA San Giorgio**, highlighted its *ICMA 4.0* co-rotating double screw extruder equipped with advanced sensors that support diagnostics capabilities for preventive maintenance planning and monitoring of specific processing parameters related to product quality. **KraussMaffei Berstorff**, a leading German company in the extrusion machinery manufacturing segment, launched the implementation of its new *BPCTouch* control system in all *ZE BluePower*, *ZE UTX* and *ZE Basic* double screw extrusion machines series, configured according to the philosophy "Industry 4.0". This control software allows guiding the operator of the machine through all the steps of the process, integrating all the peripheral components and dragging equipment.

3.2 Films

Addex, of North America, has launched its new cooling ring technology for tubular ICE (Intensive Cooling Experience) film extrusion that increases extrusion throughput of blown films by up to 60%. The patent-pending design consists of a series of cooling rings placed in a stacked configuration to achieve higher efficiencies. Each air ring directs divergent air flow along the bubble, both up and down, from each stacked cooling element.



Figure 6: Cooling ring system ICE of Addex [taken from "Film, Sheet and Extrusion" magazine, November 2016].

The renowned Italian company **Bandera** presented its five-layer *TechnoFlex Plus* extrusion line capable of producing polyolefin and barrier films (LDPE, blends with LLDPE, mLLDPE, EVA, HDPE and MDPE, EVOH and PA). The expected thickness range is between 20 and 200 microns, with production capacities of 700 kg/h for PE and 500 kg/h for barrier films.



Figure 7: Five layers Coextrusion line TechnoFlex Plus of Bandera [taken from "Film, Sheet and Extrusion" magazine, November 2016].

Colines, from Italy, presented its seven-layer co-extrusion line extruding PE resin at 1500 kg/h and producing blown film 2 meters wide and thicknesses between 6 and 30 microns, with speeds close to 700 m/min. Leading film extrusion company **Hosokawa Alpine American Inc.** showed for the first time at the show an 11-layer film co-extrusion line for an application field where flexibility is a must. The equipment has a completely nested spiral head consisting of 11 cylinders placed one inside the other, with specific channels and spirals for each layer. This allows all extruders to be at the same level. The cylindrical shape confers greater resistance and prevents the accumulation of material and the formation of gels⁽³⁾.

From Italy, **Macchi** showed his five layers *POD* extrusion line (dedicated to polyolefins)

to produce films with a decrease in thickness up to 40% of the original. For its part, **Nordson EDI** (Extrusion, Dies Industries), specializing in the design and manufacture of flat extrusion heads, redesigned its *Autoflex VI-E Lip* head to increase the stroke of the lip adjustment system by 43%, in order to allow the correction of process variations without the need for manual intervention.



Figure 8: POD extrusion line of Macchi for stand-up pouches manufacturing [taken from "Film & Sheet Extrusion" magazine, October 2016].

Rajoo Engineers from India, exhibited its five-layer *Pentafoil all-PE* co-extrusion line with cylindrical spiral die (CSD), manufacturing at a rate of 600 kg/h a film of 40 microns thick and 2000 mm wide. In terms of control systems, the renowned industrial organization **Reifenhäuser** of Germany introduced the so-called *Evolution Ultra Flat*, for the control of flatness of the film. Traditional control systems consider two parameters, the width of the film and the tolerance of the thickness profile. This new control system can measure and optimize the flatness of the film. The company also introduced a new barrier film head design, the *Evolution Ultra Die* system, which is a combination of stacking head design and spiral mandrel distribution system.

3.3 Injection

The large and well-known manufacturers of injection molding machines addressed the new frontier of the "intelligent factory" by introducing to visitors the concept of self-

regulated systems and interconnection between machines and components. Suppliers such as **Engel** with its "Inject 4.0" system, **KraussMaffei** and its "Plastics 4.0" version, **Wittmann Battenfeld** and its development "Wittmann 4.0" and the renowned **Sumitomo Demag** with its "Electrified 4.0" coined their own terms to offer their flexible systems of production to the public of the K fair. In this sense, the molding injection machines of last generation come equipped with routers and controllers configured to be compatible with the standard OPC-UA (Open Platform of Communication-Unified Architecture).

Arburg from Germany introduced an intelligent mini-plant of an *Allrounder* machine connected to a *Freeformer 3D* printer and a six-axis robot, while **Engel** promoted its electronic *e-flomo flow control* system "linked" to a water temperature control unit with variable speed pumps, both devices integrated in the system control *Engel CC300* under a new software development. **KraussMaffei** from Germany verified the reliability of its improved *APC Plus* (Adaptive Process Control) software that detects and adjusts conditions for environmental changes or resin viscosity. He also introduced his new open system for the registration and data analysis of the process called "DataXplorer". **Boy Machines** from Germany showed the world's smallest micro-injection machine, with an 8 mm diameter screw developed to limit the residence time of temperature sensitive materials.

In the segment of plastification screws, the company **ENGEL** showed its new designs that include the Universal Screw G18 UAS Automotive and the mixing screw Barrier G16S MBS to produce concentrates with high level of homogeneity in applications of high performance. The latter was developed in collaboration with the University Johannes Kepler of the city of Linz in Austria and a client in Germany. The sector of molds and accessories for the injection molding process was attended by **HASCO**, who presented his innovation in the use of plastic inserts manufactured with a 3D printing process

realized in the *Stratasys Polyjet Technology Unit* in a matter of hours.



Figure 9: Molds from Hasco with 3D printed plastic inserts [taken from web page blog.stratasys.com].

3.4 Piping

For the manufacturing sector of specialized piping systems, the company **Simona** of Germany, introduced at the fair its new line of multilayer polyethylene pipes called *PE-100 AP*, designed to provide an improved wear protection. Canadian company **CORMA**, specializing in the manufacture of machinery and tooling for moldings for corrugated pipes, introduced the new product "Super Coupling Corma" to increase the effectiveness of the sealing at the ends of the pipe, providing a larger contact area for a more robust seal.



Figure 10: "Super Coupling Corma" system for PE piping. [taken from "Pipe & Profile Extrusion" magazine. October 2016]

Tecnomatic of Italy presented two new concepts of multilayer pipe extrusion, the *Venus Multi 250 Quattro* die for the

production of four-layer PE pipes and the *Athena 5-40* for the production of PEX and PE-RT pipes. The latter includes a new radial distributor development that does not produce "dead" areas or edges in the flow of the molten material. The German company **Sikora**, specializing in non-contact measuring systems, introduced the CENTERWAVE 6000, a concept based on millimeter wave technology to measure internal and external pipe diameters, ovality, wall thickness and sinking of very long pipes with diameters from 120 to 2500 millimeters.



Figure 11: Non-contact measuring system of Sikora [taken from "Pipe & Profile Extrusion" magazine, September 2016]

3.5 Compounds

From the USA, **B&P Littleford Day**, a company specializing in the manufacture of mixing equipment, showed its *B&P Trivolution 30 TriKneader* compound extruder continuous reciprocating type which provides three kneading lobes per turn of the screw shaft, providing a good dispersive and distributive mixing with controlled cutting. **Coperion** also showed its twin screw extruder *STS 35 Mc*, optimized for the production of high quality color concentrate with a new die where the molten material flows in the form of filaments without accumulating in dead zones. This company also exposed its new underwater

pelletizer UG 750W for production rates of 60 to 70 tons per hour. **Leistritz**, a world-renowned brand and preference among composite manufacturers, exhibited its latest developments and improvements in its *ZSE MAXX* compound extrusion line and presented a series of seminars focused on application sectors of specific compounds such as bioplastics, conductive compounds, black and white concentrates, and HFFR (halogen-free) cable compounds.

3.6 Peripheral Equipment

In the area of peripheral equipment **Brabender Technologie** was highlighted, who introduced a new feeder designed to handle long and irregular fiber lengths in a wide range of formats. It allows the handling of natural fibers, wood fibers, long carbon fibers and strips of shredded film.



Figure 12: Fiber feeder of Brabender Technologies [taken from "Compounding World" magazine, November 2016].

The company **Conair** specialized in storage, transportation, drying, feeding and mixing, exhibited for the first time its new *R-Pro dense-phase* vacuum transport system that minimizes pellet fracture, fines generation and "angel hair" by moving dense clusters of material at low speed, reducing wear and dust generation. Meanwhile, **Davis-Standard** of the United States presented its line of high speed winding machines to operate up to 800 m/min with thin substrates. It is designed for extrusion

coating applications of aluminum foil with PE films with thicknesses between 30 and 100 microns. In the area of peripheral equipment, the Italian company **Frigel Firenze SpA** was highlighted, who introduced its *3PR control technology* with wi-fi and ethernet connectivity for its line of temperature controllers and *Microgel* portable coolers along with a new control platform that includes touch screens in full color.

Koch-Technik, the German specialist in dosing, transportation, mixing and drying, launched its new vacuum transport system called *Duo vacuum* to feed plastic pellets to two injection molding machines or material dryers, which includes a vacuum generator three phases. **Kreyenborg**, a leading German company in material handling systems, showed its equipment for drying and crystallization along with solutions for the handling of bulk material. Infrared rotary dryers (IRD) are used for the crystallization and/or drying of virgin or recycled ABS, EVA, HDPE, PC, PEEK, PET, PLA, PPS, PTFE, TPE and TPU materials. The company also introduced its new pneumatic conveying system to handle bulk materials with low fluidity such as flakes of bottles or films. **Sikora**, a German company specializing in inspection systems, presented its *Purity Concept* line for the inspection and analysis of pellets, flakes, films and tapes in the peripheral segment for strict control of contaminants in inputs. The modular system is available for on-line or off-line use and is based on X-ray, infrared and optical technologies. The system can detect and separate 50 micron contaminants on the surface and inside of the plastic pellet. Removal is automatic.

3.7 Other processes

Featured among leading ultrasonic welding companies, **Branson Ultrasonics** demonstrated the advances made in laser welding when debuting with the GLX-3 system, demonstrating its capabilities in joining large-format plastic and complex geometry. Using the patented STTIr (*Simultaneous Thru-Transmission Infrared*)

process, the *GLX-3* line heats, fuses, and joins the entire weld line in one go.

The latest technological advances and state of the art in Europe and the world of laser use in applications are conducted by the **Fraunhofer Institute for Laser Technology of Germany**. During the K fair, the institution presented an advanced technology in the joining of thermoplastics to metallic surfaces field, first accomplishing a microstructure on the metal surface by means of the laser, which forms hollows underneath and a rough surface, in such a way that the material plastic, melted by the laser, penetrates these spaces and is firmly anchored. The thermoforming process was supported by **GN Thermoforming Equipment** from Nova Scotia, Canada, who first exhibited its *GN800* machine, which can handle sheet widths up to 880 mm and thicknesses between 0.25 and 1.5 mm, to produce thermoformed food, medical and industrial packaging.

Maag presented its latest underwater pelletizing system incorporating melt pumps, mesh filter changers, diverter valves, cutting chambers, cutting systems, tools and controls. **Maguire** unveiled its new *LoPro vacuum material loading system* to transport pellets or recycle from the storage site to multiple mixing systems. Designed to save space, the system receivers protrude 200 mm from the mixer cover, providing a low center of gravity that avoids potential unbalance in processing machines with fast cycles.



Figure 13: New LoPro vacuum material loading system of Maguire [taken from "Film & Sheet Extrusion" magazine. October 2016].

Nordson Corporation, a North American manufacturer of precision equipment for the application of adhesives, powder and liquid coatings, varnishes, sealants, biomaterials, polymers and plastics among others, fluid dosing equipment, testing and inspection equipment for curing UV and plasma surface treatment, showed its new filtration system for highly contaminated plastics, the *BKG HiCon R-Type 250*, designed to handle polyolefins or styrenic resins. The development employs a cylindrical separating die with blades arranged on its surface in a helical pattern separating the contaminating particles as it rotates.



Figure 14. New filter system for contaminated plastics of Nordson Corporation [taken from web page www.nordson.com].

Pro Tec Polymer Processing GmbH from Germany presented its *SOMOS Batchmix XL* batch mixing unit with yields of up to 1,920 kg/h and the *SOMOS RDT-200 stationary dry air dryer* for the feeding and drying of multi-component blends for injection molding machines and extruders, designed to handle up to six components.

4 LABORATORY EQUIPMENT

Multiple organizations and companies reserved a place in the pavilions of the fair K2016, among the most recognized are mentioned:

- **Instron**, which showed its new series of HDT and Vicat test equipment called the *Instron HV Series* with an *HV6X* model with six test stations and an automatic weight application.

- **JSW (Japan Steel Works)**, who demonstrated with its new 26 "diameter twin screw extruder *TEXaIII*, equipped with a side feeder to develop engineering materials and high performance composites including PEEK, PPA, PPS, LCP, PEI, PI, as well as TPVs.



Figure 15: Extruder TEXaIII of JSW.

- **Lab Tech Engineering Company Ltd**, of Thailand, which occupied an important area in Pavilion No. 7 with the full range of extruders, mills, film blowing lines, composite lines, pelletizers, among others, configured to produce from laboratory scale.



Figure 16: Twin screw extrusion line for compounding of Lab Tech Engineering [taken from web page www.labtechengineering.com]

- **Arizona Instrument**, a US company specialized in laboratory equipment, introduced the *Computrac Vapor Pro XL*, a moisture analyzer that does not require chemical solvents and is the alternative to the traditional Karl-Fischer method.

5 TRENDS IN PLASTIC WASTE HANDLING

"Plastic is too valuable to be buried," a phrase taken from the conference by Patrick

Thomas, CEO of Covestro AG, who emphasized the need to have "zero tolerance" for waste in the global plastics industry. Every ton of plastic that goes to landfills is a waste that is too valuable to go in that way. He said that there are around 100 environmental projects in the world, involving some 65 organizations, looking for ways to highlight the problem of marine debris and to educate consumers in the disposal of their plastics in a responsible manner, so that they do not end up being launched into the marine environment. Consumers must change their behavior to raise recycling rates as landfill restrictions enter into force and those countries that have adopted legislation related to the subject have seen their recycling activity increase. Areas to consider for recycling include resource efficiency, education, public policy, sharing of best practices and appropriate infrastructures established *on-site* to deal with the waste stream.

There was participation of companies that offer equipment for the recycling of resins such as **Erema**, **NGR**, **Polystar** and **AMUT** of Italy; the latter presented its line for the management of post-consumer waste, which selects and classifies them in organic, paper, metal, paperboard, glass and plastic. The Italian company **FIMIC** exposed its *ERA casting filtration system* for highly contaminated material applications, which incorporates two filtration chambers that provide two levels of filtration in a single unit. Typical filter arrangements would use filters with 400 micron holes in the first section and 150 microns in the second. The two chambers are independently operated with separate discharge valves. The German company specializing in separation technology, washing technology, drying and shredding technology, **Lindner Washtec**, exhibited its highly contaminated post-consumer compact pre-wash plastic *Rafter system* with three cleaning phases and a throughput of 1500 to 2500 kilograms per hour.



Figure 17: Pre-washing unit Rafter of Lindner Washtec [taken from "Film & Sheet Extrusion" magazine. October 2016].

6 SUMMARY AND CONCLUSIONS.

The International Trade Fair K again became the meeting point of the plastic industry worldwide and in the event where the leading companies present their advances and innovations. The conclusions that derive from this important exhibition are:

- The focus of the industry is clearly aimed at reducing environmental impact. The vast majority of manufacturers presented innovations that represent a contribution of the company to a better environment: lower energy consumption, less generation of waste, greater capacity of recycling. The resin producers focused their strategies at the fair towards applications that represent alternatives of sustainability and compatibility with the environment.
- "Industry 4.0", a term coined by the German government to describe the intelligent factory, has become a real and tangible vision of computerized manufacturing with all processes interconnected via Internet, where the efforts of European industry are centered and with it, the worldwide industry.
- It emphasizes the use of robotics to save time in the manipulation, assembly of parts and/or processes.
- Machinery exhibitors make strategic partnerships with producers of resins, additives, accessories manufacturers and robots to present in one stand all their



**International Trade Fair
No.1 for Plastics
and Rubber Worldwide**

**TECHNICAL BULLETIN:
K FAIR 2016**



products in full operation, possibly in response to increased competition in these markets.

- The participation of companies in the Asian region (especially China) is increasing, both in terms of numbers and technical sophistication.
- The presence of Italian manufacturers of equipment for processing and preparation of compounds was highlighted.
- Application and resin developments have focused their efforts on the production of technical parts mainly for the automotive market, with constant improvements in the techniques of design to 3D printing, with the incorporation of new materials that provide the possibility of combining two or more colors and textures.

Finally, it is confirmed that the triennial appointment in Dusseldorf is necessary to know, in a very close approaching and in a global way, the direction in which the plastic industry is headed. The next fair will be in October 2019.

7 BIBLIOGRAPHICS REFERENCES

1. *Compounding World*. **Applied Market Information Ltd.** Bristol, United Kingdom :

AMI plastics, 2016, Vol. September 2016. ISSN 2053-7174.

2. *Compounding World* . **Applied Market Information Ltd.** Bristol. United Kingdom : AMI Plastics, 2016, Vol. October 2016. ISSN 2053-7174.

3. *Plastics News Europe*. **Crain Communications, Inc.** Detroit, Michigan. USA. : s.n., 2016, Vols. October 25/26, 2016.

4. **Schellerer, Karl-Martin, y otros, y otros.** *Polyvinyl Chloride (PVC) - Plastics World Market - Kunststoffe International 10/2016*. Munich : Carl Hanser, 2016.

5. **Mapleston, Peter.** *Automating the mixing process. Continuous and batch mixers. Processing*. Bristol. United Kingdom : Compounding World. November 2016, 2016. ISSN 2053-7174.

6. *Film & Sheet Extrusion*. **Applied Market Information Ltd.** Bristol, United Kingdom : AMI Plastics, 2016, Vol. September 2016. ISSN 2053-7190.

This Bulletin was issued by the Marketing Management of Poliolefinas Internacionales, C. A. (POLINTER), with support of Investigación y Desarrollo, C. A. (INDESCA), in Caracas, Venezuela, in September 2017.

If you would like to make a comment or suggestion, please write to the Marketing Management at the e-mail address: info@polinter.com.ve, which can be accessed through our website www.polinter.com.ve or our commercial agent "Corporación Americana de Resinas", CORAMER, C. A. (<http://www.coramer.com>).

Information described in this document is, to the best of our knowledge, accurate and truthful. However, because particular and variable uses of transformation processes are entirely beyond our control, the adjustment of parameters that allow us to reach maximum performance of our products for a specific application is responsibility of the user and we trust in which the information contained in it is of its maximum profit and utility.

For more detailed information on safety aspects related to handling and disposal of our products, we invite you to consult safety data sheets (MSDS) of Venelene® Polyethylene.