

# ROUNDTABLE ON EXTRUSION EQUIPMENT

**Q:** Last year was a big year for advances in extrusion equipment. Can you recap 2016 as it pertains to your company and also preview what 2017 may have in store?

**Andrews:** 2016 was a big year with new extrusion technology for W&H. We follow Packaging 4.0 guidelines – our vision of Industry 4.0 – with all new developments being intelligent, integrated and intuitive. Our big highlights for 2016 were the addition of the TURBOCLEAN automated resin purging and job changeover system, reducing changeovers to roughly 12 minutes, just one-third of the time for manual changeovers. Another highlight was the introduction of Film Performance Monitor (FPM) on our FILMEX cast film line. FPM monitors data of the full production, which is saved on a QR code and can be scanned for downstream processing. This links the film's physical appearance back to key process parameters.

**DeSpain:** 2016 was an incredible year not only for Reifenhauser Inc. here in North America, but also for Reifenhauser worldwide, culminating with the K-Show where we debuted several new things, including our Ultra Stretch system and Ultra Die for barrier applications. We also have several new releases on our rigid packaging side, including our new high-speed extruder and MT polishing stack. We are in the process of updating our lab lines in Troisdorf (Germany) with some exciting updates, including new high-output options and Industry 4.0 control systems.

**Campbell:** The 2016 election may have dominated the news, but there were huge developments in blown film extrusion equipment as well. Alpine Ameri-



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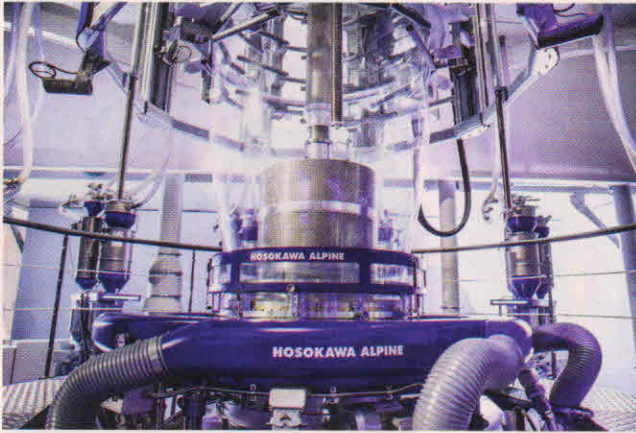
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can enjoyed a fruitful year in volume and technology. Several polyolefin-dedicated 5-layer lines were installed for a variety of end-use applications. "Five is the new three" technology allows for cost reduction of the most expensive component in blown film and resin, and offers potential for customizing and improving physical properties of the film. Material cost savings alone pay for the additional capital expense many times over in the first year or two. Other exciting news includes the introduction of Alpine's patented X-Die for 11 layers, providing the ultimate in material and process versatility. The X-Die's proven technology to process a wide range of



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pressures offers processors the ability to produce advanced barrier films and high-performance PE films on the same line. Flexibility, processability and, most importantly, profitability are all available on a single Alpine 11-layer X-Die



A Hosokawa Alpine extrusion system.



A look inside Davis-Standard's tech center.

line. The forecast remains positive for flexible packaging, and we are always working on new advancements – some small and some big.

**Christie:** 2016 was a record year for SAM in extrusion coating. Business

was evenly distributed in America, Asia and Europe. Like packaging films, extrusion coating is trending to more layers, and many companies run development trials in our Extrusion Coating Lab to investigate multi-layer enhancements for perfor-

mance. In Europe and the Americas, we see growth in specialty co-extrusions, where many customers are looking to our lab to evaluate more polymers and layer structures for barrier, strength or sealing improvements. Many Asian converters have

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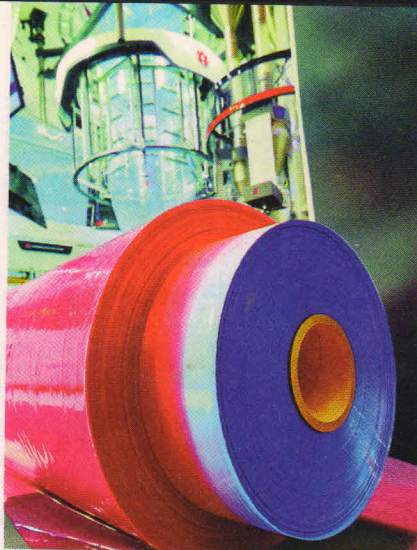
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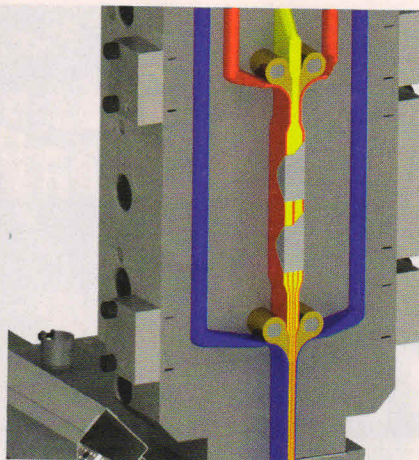
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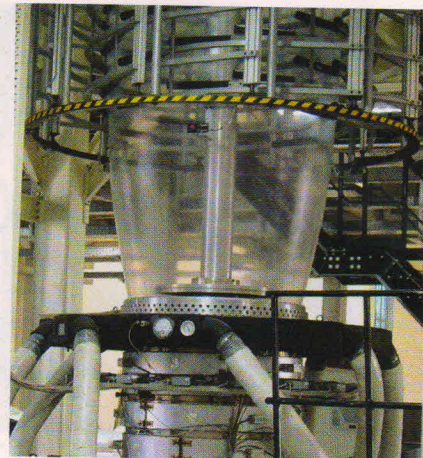
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W&H demonstrated the TURBOCLEAN automated resin purging and changeover system.



SAM's ability to downgauge is enhanced through layer multiplication, shown here.



Mamata's MES 3-layer line.

historically run narrow web, low-speed coating lines for small regional markets. We have been supplying this region with higher speed, higher capacity lines, to satisfy a demand for their growing markets. Energy and sustainability are on everyone's mind, and we see more converters making the move to improved technology for reduced energy consumption. We see these same trends continuing into 2017.

**Christiano:** Last year, we continued to work on optimizing performance for flexible packaging applications by improving energy efficiency of single-screw extrusion platforms. We will continue to do this in 2017. This effort focuses on both extruder and screw design. Our new barrel heating and cooling systems improve extruder energy efficiency by reducing radiant and convective heat loss to the working environment. We've found improvements in energy efficiency for extrusion coating applications ranging between 30 and 50 percent. Added efficiencies are possible when using extruder platforms that employ direct-drive and high-speed technologies.

**Cros:** 2016 has been Pearl Technologies' best year so far for extrusion products. The expertise we have de-

veloped over the years – along with the constant development of new features and materials – has been paying off in a big way. Our customers, both end users and extrusion OEMs, have tested the value of Pearl products. One of our latest developments, Pearl Blue Slat, which features a lower coefficient of friction as well as anti-static properties, has become our best seller and is used on multiple applications from collapsing frames to gusset boards and turning bars or non-turning idlers. We also unveiled our best-ever aluminum coating, Platinum SM-28, with an even lower COF and harder surface than our widely used Black SM-28. This coating is also available on most of our extrusion products, including cage arms, pre-nip chillers and spreader bars.

In 2016, we set a new record for gusset boards, designing and manufacturing more than ever and ranging anywhere from 3 to 60 feet long, all for various applications. To help our customers with their specific requirements, we have been challenged to design specific boards with cutouts, removable noses or side panels. 2017 will see the first actuated removeable nose gusset board, allowing customers to remotely retract the nose into the body of the board. This feature will reduce setup times

by hours and give customers a huge increase in flexibility for their line schedules. Along with this innovation, we have developed a new set of actuators that will also allow remote movement of the board itself.

Pearl also improved the design of its Z-Lift Bubble Cage with a lighter, more versatile design. Here again our progress in actuation will now allow us to use motorized settings for bubble-cage height as well as diameter.

**Shankar:** Last year, we supplied many lines for targeted applications with advances in design, development and customizations, mainly 3-layer blown film lines. For instance, seven of our customers in India made 3-layer thin films up to 12 microns (0.47 mil) for lamination with BOPET/BOPP/paper, etc. These films were made commercially successful due to proven hot package and customized post-extrusion equipment, mainly the secondary nip slitting/trimming and winders to handle such thin films at approximately 100 m/min line speed. We also had a major contribution on an upgrade of a local line with our proven hot packages to increase the outputs by 50 to 60 percent. This upgrade process also improved gauge control by 30 to 40 percent, reduced wastage by 1 to 2 percent and (im-

proved) overall profitability to payback the upgrade cost within a year.

In 2017, we've seen one of our customers make 10 micron film with a PP-based blend for a woven sack. This is direct replacement of 10 micron (0.39 mil) BOPP film and offers huge cost benefits to the manufacturer and industry. We are going to supply a compact, customized 3-layer blown film line with output of 130 to 150 kg/hour in Singapore to be installed on the fifth floor of an industrial shed with a height of only around 7.5 meters. This is one of the most expensive sheds anywhere in the world. Hence, the viability of the project is based on many value-added films to be produced on this line.

**Q:** Aside from decreasing changeover times, how is extrusion equipment becoming more sustainable?

**DeSpain:** The whole 3-layer moving to 5-layer for POD (polyolefin dedicated) trend is helping make things more sustainable due to the downgauging of certain products or the ability to bury regrind. In addition, Reifenhauser is a member of the Blue Competence group in Europe that works on providing the most energy-efficient machinery possible.

**Shankar:** We already have lines running, which can work uninterrupted for a month with just one day of shutdown. Other developments to permit extrusion equipment that we've worked on include reducing overall waste below 1 percent due to online slitting devices without edge trim for most of the in-house consumption of the films. One of our customers has adopted a zero waste policy using our line. For that line, we made a provision to let the online trims be directly fed into the middle layer extruder just by twisting and shredding the trim. This is possible due to smooth bore extruders and feeding directly to the hoppers and having other pre-blended resins just above the feed sections of the barrels. The rest of the startup wastages are being pulverized offline.

**Campbell:** Decreasing changeover times, reduced scrap, increased up time all contribute to improving the sustainability of the blown film process. Alpine American continues to improve these and other phases of the blown-film process. The X-Die naturally reduces changeover times by requiring less resin in the die to produce a given film. Less resin in the die means quicker changeover and less scrap. Resin handling and changeover time is a topical point of discussion, and Alpine American is working closely with several resin-blending and material-handling suppliers, and will have a variety of options and solutions going forward. Sustainabil-

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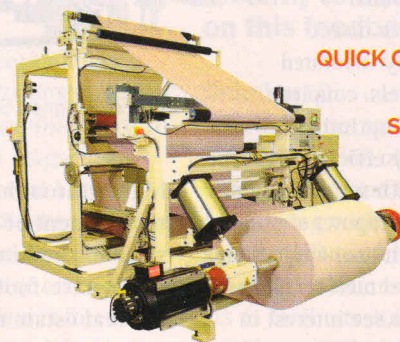
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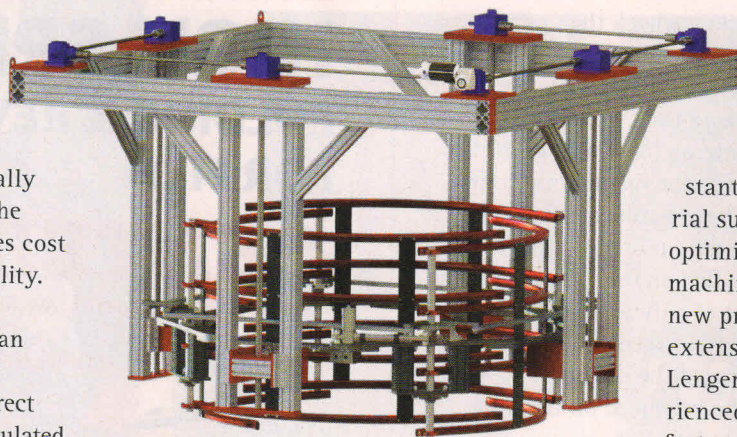
ity in the process is also improved by increasing the efficiency of motors and drives. These improvements are typically incremental. However, the cumulative result reduces cost and improves sustainability.

**Christie:** We introduced an energy-efficient extruder several years ago with direct torque drive and fully insulated infrared-heated barrels, coupled with our application-optimized screw design. Energy efficiency can be further enhanced with screw designs optimized through computer simulation and coupled with ozone injection to reduce the required melt temperatures. We continue to see interest in sustainable materials, and many of our lab trials revolve around this aspect of the market. The ability to downgauge is enhanced through layer multiplication, which is also an active area of interest for customers in our lab.

**Andrews:** At W&H, we are constantly striving to design extrusion systems that can reduce waste material, some of which may not be able to be reprocessed. As an example, implementation of systems with improved bubble stability and tight width control at increased throughput reduces or eliminates the need to take edge trim, which can be up to 5 to 6 percent of the finished width. The use of spreading and slitting devices enables the winding of multiple film reels without the need to take bleed trims.

Films with significantly lower gauge variation allow for the downgauging of films. Increasing the number of layers in co-extrusion can also allow for optimization of film properties at thinner gauge.

Additionally, we've worked on control modules to reduce the time for startup of the machines. Investing in new extrusion systems with



Pearl's redesigned Bubble cage with Z-Lift option.

higher throughput can lead to the replacement of older, less efficient systems, and increase the pounds-per-square-foot produced relative to the real estate required that can start to reduce the energy requirements for power and heating buildings. W&H designs extrusion systems to be energy efficient, keeping in mind the balance of heating and cooling. Using an energy-monitoring module, you can see real-time energy consumption. From this, the heating and cooling functions can be adjusted to find the optimal balance.

**Q:** With films and resins changing and becoming more sophisticated all the time, how does your company work to keep up?

**Cros:** Pearl created an application lab complete with testing equipment and measuring tools. This facility allows us to perform testing on an array of equipment (both converting and extrusion), and we have encouraged our customers to send us film and material for testing. We now have the ability to test the resistance and friction of our various slat surfaces on actual film produced by our customer. This has proven very useful in the year – both in selecting the best possible surface for a specific

application and also to develop new features and technology.

**Andrews:** W&H is constantly working with the material suppliers and customers to optimize film formulations and machinery configurations for new products and markets. Our extensive technical facilities in Lengerich (Germany) and experienced personnel are significant factors. W&H also continues to attend and support leading industry conferences to find out about new materials.

**Christie:** SAM's Extrusion Coating Lab is entering its third year of operation, and our customer trials involve many novel materials or applications. Frequently, resin suppliers are bringing their new materials to evaluate in our lab due to the application versatility we supply with four pre-treatment options: corona, primer, flame and ozone. We also offer up to 14 layers of co-extrusion for coating and laminating.

**DeSpain:** We have a whole team dedicated to this, and we spend a large amount of money every year on R&D and product development. We are working with CPGs and end users to understand their needs in order to help our customers develop new products and, of course, we are in constant touch with all the major material suppliers, including running many trials with them on our lab lines in Germany.

**Shankar:** We have a team of dedicated, qualified polymer engineers who understand rheology of new polymers. We also interact frequently with leading raw material manufacturers and help our customers to identify new applications to optimize recipes from the point of view of performance and cost. We also developed the M-CAT (Mamata

Critical Analytical Tool) app to understand the applications of the customer and offer a customized line at the macro ... (and) micro level of each and every system element of the blown film line. Based on past experience, customer demand and required performances, we customize all of our lines. To ensure how we walk the talk, we supply each and every line only after successful pre-dispatch wet trials to meet the acceptance protocols.

**Christiano:** Our large development laboratory in Pawcatuck, Connecticut, is essential to helping us address evolving industry demands and production requirements. This lab has a selection of single-screw extruders ranging from three-quarter inch (19mm) to 4.5 inches (115mm) in diameter, used for developing state-of-the-art screw designs for new materials being introduced to the

industry. The lab is staffed by experienced polymer-processing engineers who work directly with customers. We are also able to support a wide range of single-screw technologies, including conventional smooth bore, groove feed and high-speed extruder platforms. We have regional laboratories at our subsidiaries in Suzhou, China, and Erkrath, Germany, to further support R&D efforts and customer trials.

**Campbell:** Alpine American has very close working relationships with all major resin suppliers. Our full production scale lab in Augsburg, Germany, contains several blown film lines that continuously run blown film trials to test new resins and develop cutting-edge technology. Additionally, Alpine is fortunate to have installed commercial-size blown film lines in technical centers of many of the major resin suppliers.

Together with the resin companies, we are always working to develop better solutions for customers' needs.

**Q:** What's some of the most common feedback you receive from customers regarding extrusion equipment? Are there any improvements that you've made recently to equipment based on this feedback?

**Shankar:** Our customers are facing challenges such as mixing and homogenization of the HD rich blend. Current solutions to the problem are playing with layer ratios while keeping HD contents the same. Our proposed solutions are to split layers to facilitate 100 percent HDPE in 5-layer POD. Additionally, the market is trending toward thinner films below 20 microns (0.79 mil) in



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3 layers. We have started promoting a higher line speed of 150 mpm (492 feet per minute). Currently, people are comfortable up to 100 mpm (328 feet per minute) for even 10 micron (0.39 mil) film. This will help to maintain a reasonable level of output even with such thinner gauge film.

**Campbell:** Increasing rates, improved efficiency, more sophisticated controls and, most importantly, better film quality and consistency. Every decision we make in terms of developments and R&D is focused on those exact demands and the needs of our customers. Additionally, customers are always interested in upgrading current assets, and we work closely with them to identify the low-hanging fruit with the greatest opportunity for high returns. Retrofits are more demanding and require more work for the OEM than new lines, and we work diligently to streamline the upgrade process.

**DeSpain:** All customers want the most efficient and flexible line possible, and always at the best possible price and delivery. They are also looking for high quality as their customers are becoming more demanding. Our Ultra Flat system stemmed from a customer asking us to help them get flatter film and, to date, we have sold over 50 of these units worldwide now.

**Christiano:** Continuous improvement focused on boosting production line efficiency is a constant theme for our customers. We support this effort by providing integrated control systems to help customers create a smarter factory. Our systems enable processors to connect and communicate with multiple lines and our support staff. This includes remote access for gathering information from equipment sensors for troubleshooting and maintenance. Technical assistance for line optimization using remote teams is a big part of this.

**Cros:** (Almost) all our innovations come from customer feedback. Pearl is happy to offer help and work alongside an extruder, creating product solutions that meet the customer's needs, even if it's a new or custom application. For example, in 2017 we will unveil our remotely adjustable spreader bar. This piece of equipment is designed to remove wrinkles and is typically the innovative, cost-efficient replacement for bowed rollers. Pearl has been very successful over the years with this manually adjusted product. Recently, we received feedback from several of our customers who were not taking advantage of the adjustable bow because the bar was mounted in a hard-to-reach position in the tower. Upon hearing this, we developed a simple actuation and remote control to allow them (to use) this feature and improve the value of this product.

**Christie:** Customers are looking for a quick and accurate response to their request for quotation. SAM has always focused on preparing detailed and pre-engineered quotations, and responding within the customer's required timeline. Customers require fast, turn-key installation, which SAM has focused on by fully wiring and running each line in our factory before shipment. From an execution standpoint, project management is key. SAM has long used a project team engineering approach with focused project managers.

Customers are also requesting system design flexibility to meet unknown future product changes. Today's converters are asking machinery suppliers to be part of their ongoing worker development. SAM frequently provides comprehensive operator and maintenance training to support this need. Customers are also seeking improved operator safety. SAM has led the extrusion-coating industry by introducing full-zone guarding with safety PLC interlocking control as early as 2012.

**Andrews:** W&H always listens to customers – that's how you recognize market needs and address them. Buzz continues to be about productivity, changeovers, reducing waste, lowering energy costs, etc.

### **Q:** Is there anything else you'd like to share about extrusion equipment?

**Andrews:** Of course an extrusion line is extremely important, but it's not the only factor in determining success. Experienced and knowledgeable operators should never be underestimated. W&H runs extensive operator training, and electrical and mechanical engineers from our service department are reachable 24/7 for assistance. Process training, troubleshooting and optimization are also important to many of our customers.

**DeSpain:** The market for all types of extrusion equipment is still relatively strong, so we feel very good about the market worldwide. We see third-world countries developing a middle class that is putting demand on improved product. And demand for higher quality, more efficient machinery elsewhere means customers must continue to invest in modernizing their factories or they will be surpassed by their competition.

**Campbell:** As flexible packaging continues to be the material of choice in packaging, we the equipment suppliers must keep up with customers' demands and needs.

**Shankar:** We believe blown film is going to replace many of the cast film applications, and we geared up to offer B.U.R. up to 3.2 even for 80 percent LLDPE/m-LLDPE rich blend. There are many applications in various fields where cast film will be replaced by blown film even using PP-based blend, and we are extending our support accordingly. **FP**