

Q&A WITH DIRK SMITS OF IBS PRECISION ENGINEERING:

IMPROVING R2R PROCESSING WITH NEW WAY'S
NON-CONTACT AIR TURNS



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IBS Precision Engineering Expert Discusses Improving R2R Processing Technology

This Q&A is based on an interview conducted with Dirk Smits of IBS Precision Engineering on September 28, 2017, and covers subject matter related to [improving R2R processing](#) technology using non-contact air turns.

[Dirk Smits](#) serves as Sales Manager for [IBS Precision Engineering](#). Smits joined IBS in 2004, after engineering and account management roles with [Axxicon](#) and [Baetsen Groep](#). With a strong background in both the Semiconductor Industry and Organic Photovoltaics (OPV), he has worked closely with [New Way Air Bearings](#) now for almost 20 years. Smits is a graduate of [Fontys University of Applied Sciences](#) in Eindhoven, the Netherlands, with a degree in mechanical engineering.



DIRK SMITS
Sales Manager
IBS Precision Engineering

About IBS Precision Engineering

IBS Precision Engineering is a leading innovator in the field of high-precision engineering, specializing in the development of custom-engineered measurement and positioning solutions, machine tool calibration/inspection systems, non-contact precision sensors, and [air bearings](#). IBS has demonstrated its commitment to research and development, both at a national and international level, and has established close relations with many leading knowledge centers, including Eindhoven itself, where the company is headquartered.



Air Turns Are Converting the Converting Industry



Organic Photovoltaics (OPV)

The converting industry currently relies largely on the passive conveyance of flexible substrates, including paper, film, plastic, glass, and printed circuits.

But next-generation consumer electronics devices are increasingly requiring flexible form factors which, in turn, necessitate polymeric film substrates. Most of these materials are manufactured in roll form, so there has been a

corresponding acceleration in the utilization of roll-to-roll (R2R) processing.

Increasingly, these R2R production methodologies require active, non-contact handling. The efficiency of concurrent tactical coating operations on both sides of a substrate exemplify this need.

Question: How did you get involved in roll-to-roll (R2R) technology?

Answer: “There is a lot of innovation going on in the Eindhoven area in the Netherlands, where both companies and institutes are developing Organic Photovoltaics (OPV,)” noted Dirk Smits, Sales Manager, for IBS Precision Engineering. “They are applying roll-to-roll technologies because these are the only way to make OPV economically viable at large volume.”

Question: Where is R2R processing used?

Answer: Roll-to-roll (R2R) processing isn’t new. In fact, it has been around in some form for hundreds of years. But the commercial application of this technology to highly-technical, precision applications really dates back to the 1970s, primarily for optics.

What started as the processing of patterned or unpatterned film now extends to the conversion of film, foil, paper, nonwovens, and other flexible, web-based materials, notably for applications in high-tech industries including:

- Semiconductors
- Photovoltaics (PV) and Organic Photovoltaics (OPV)
- High-Brightness LED
- Flat Panel Display (FPD)
- Micro-Electromechanical Systems (MEMS)
- Printed and Flexible Electronics
- Related Micro and Nano-Electronics

The [United States Department of Energy](#) estimates that the global flexible electronics market will exceed \$13.23 billion in 2020, growing at a compound annual growth rate (CAGR) of 21.73% since 2014.

*Footnote: Flexible Electronics Market by Components, Circuit Structure Application, and by Geography - Analysis & Forecast to 2014 – 2020, By: marketsandmarkets.com, Publishing Date: July 2014, 1298 (Report Code: SE 2571.)



Contact and Contaminates in R2R Technology

Question: What are the issues limiting the application of R2R technology for precision applications?

Answer: “One of the issues that the institutes in Eindhoven and elsewhere have had is that, with contact on standard idle rollers, you get contamination and scratching, which decrease the yield of the process enormously. So, the industry as a whole is looking for different applications to carry, rotate, and turn the foil and other substrates.”

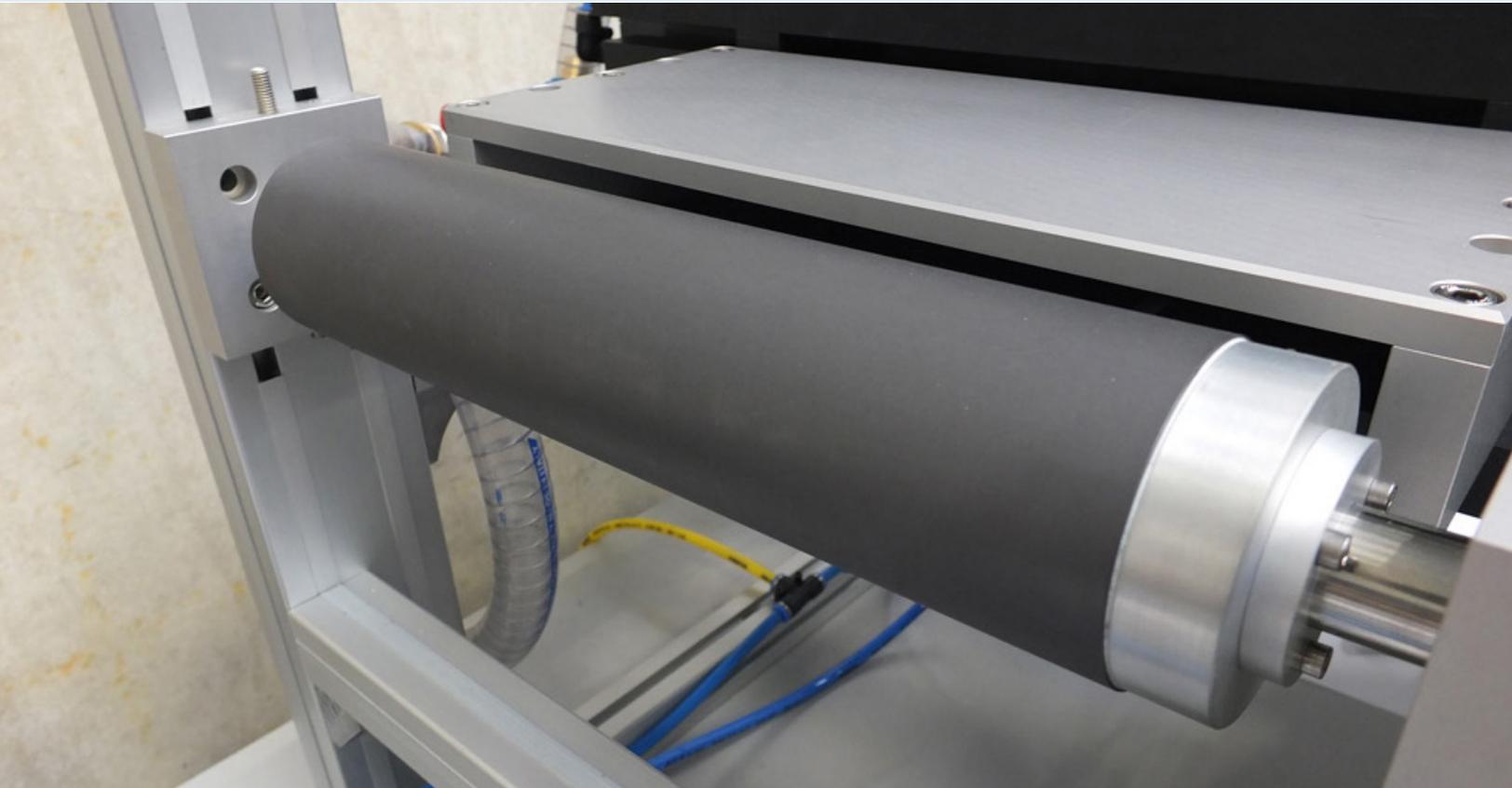
Question: How did IBS actually enter the picture?

Answer: “We go to the [LOPEC Conference](#) every year. (The 2018 Conference will be held in Munich, March 13-15.) There we meet people involved in the process of producing and improving the R2R products, printed electronics, and flexible substrates. What they told us is that with every contact, contaminant is added.

In some cases, this is not such a big problem but, especially if you go to OLED-type production, a piece of contaminant will lead to big black spots, which is obviously not something that you want on an OLED screen.

So it is inevitable that new solutions must be created. Either you go to extreme high glosses, or you make sure that you don't make contact, at least on the printed side of the process.

That's where we come in.



How New Way Developed the Air Turn from Previous Successes

Question: Where did you find a non-contact solution?

Answer: “Drew Devitt at New Way had the great idea of making an ‘Inside-Out’ air bushing. IBS had long represented New Way in Europe, marketing their standard [air bearing](#) and [air bushing](#) products. This new concept turned the air bushing inside-out, placing the porous carbon on the exterior. This eventually led to the development of the [air turn](#).”

With the [air turn](#), we can create a thin, stiff layer of air above a cylindrical surface that will turn or support the moving substrate, without contact. By avoiding mechanical contact, the defects and contamination prevalent in roll-to-roll production can be also greatly reduced.

Question: How has the testing worked out?

Answer: “We have a long history with New Way, obviously, so when Drew had this idea and we tested it, the results were quite good from the beginning. The air turn is similar in concept to [New Way’s Air Bar product line](#), which has been used with great success in the [Flat Panel Display industry](#). So we immediately got a lift of about 100 microns, which is perfect for non-contact handling. Subsequently, we have implemented air turns locally on different lines. The testing confirmed our initial results, so we’ve picked it up from there.”



A Single, Stabilizing Solution

Question: Where can you apply air turns in a web process?

Answer: There are a number of applications in R2R processing where air turns can be placed, and a number of existing products that can potentially be replaced, including:

- 1. Turn Bars** – which flip the film at a right angle;
- 2. Rollers** – including feed, idler, drive, return, and miscellaneous rollers throughout these systems; and
- 3. Tension Bars** – which are essentially rollers that move up and down to apply tension to the web.

If there are issues with friction, speed, maintenance, wrinkling, or contact using conventional rollers which result in damage to the film, [air turns](#) may provide a solution.

Air turns can also replace tension bars with a non-contact solution, with the added advantage that they don't even need to move vertically. The same level of control or better can be achieved simply by increasing or decreasing the air pressure.

Question: What other solutions does IBS recommend to solve these R2R issues?

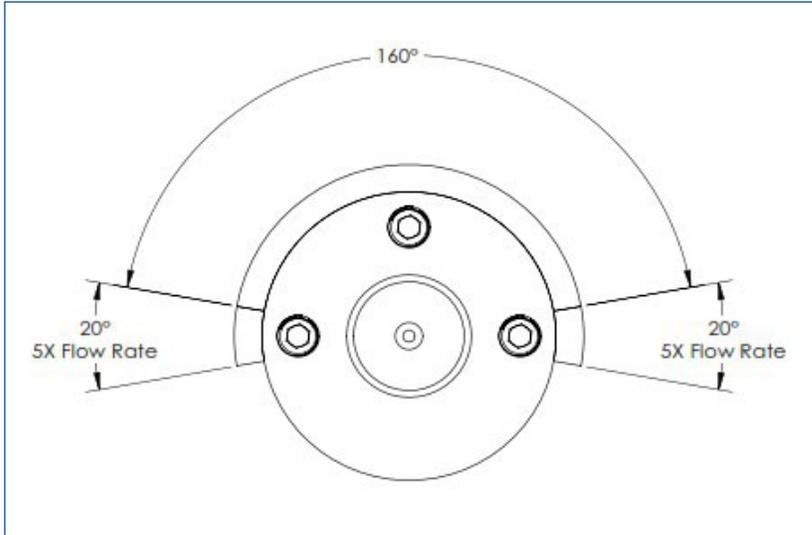
Answer: “I know that there are other solutions, such as tubes with holes in them, but that is really low-tech. You get a lot of air flow and a lot laminar flow that, in the end, will only produce more vibration in the web, which is not particularly good if you want to print on it.

The air turn that I have described significantly reduces vibration. In fact, it provides much greater control, so it is actually very useful in stabilizing the web. Again, we learned this working with more rigid substrates for Flat Panel Displays.

New Way's approach works by transmitting Clean Dry Air (CDA) through millions of sub-micron-sized holes which occur naturally in the [porous media](#) material that they use, supplying air pressure equally across the entire face of the air turn. This concurrently controls air flow, reduces laminar flow, and makes it much more difficult for the web to touch down.

“So this is the single solution that we are looking at.”

The Cleaner the Better, with Air Turns or Without



Question: Can the particles you mentioned earlier still damage the film?

Answer: “What we have found is that they are not the same particles. Because New Way Air Turns are a non-contact solution, they don’t create particles when the web touches down, as other systems do.

But if the room is not clean, particles from the outside could potentially be trapped where the air gap is smallest. What we’ve found is that increasing the air gap at the beginning and the end of the air turns solves this problem.

For webs operating in a clean room environment, we have not seen any issues. IBS has supplied air turns for the optical film industry here in the Netherlands. These systems have been running with those air turns for almost two years now in high Clean Room Class (ISO-5) environments, and we have not heard of any issues. So they seem to work extremely well.”

Question: Can you elaborate on those two years the air turns have been in the field?

Answer: “Another example that I can offer from the optical film industry may translate to other applications as well. They produce optical film with a width of about 1.5 meters. For this purpose they were using a standard idle roller, but the idle roller itself was so long that it had a lot of internal friction. The momentum it took to get the web running, pulled the foil across an auto roller, which was always scratching the optical film.

Now that they are using [New Way Air Turns](#), there is no contact anymore, so they don’t have the issue of a big, heavy air turn that needs to follow a web. This solved a huge issue for them.”

Custom Air Turn Solutions Designed with the Customer in Mind



Question: How would you characterize your relationship with New Way?

Answer: “Well, as you know, we have a longstanding relationship, and we are always able to reach a solution. So flexibility is a big part of it. Perhaps I could better describe it this way: New Way has a standard product line, but they are not limited by standard thinking. They also provide custom products, where necessary, and they have an inherent ability to think outside the box.”

The air turn is an excellent conceptual example of this. But the field is a different animal, and it requires great flexibility, especially during the development process. New Way offers precisely that.

There are different form factors, specific shapes where the air turn attaches to the rest of the R2R system. New Way is capable of manufacturing the necessary shapes and forms in the required lengths and widths, so IBS customers can simply change them out for their existing idle rollers or orifice-based air turns. This makes installation simple.

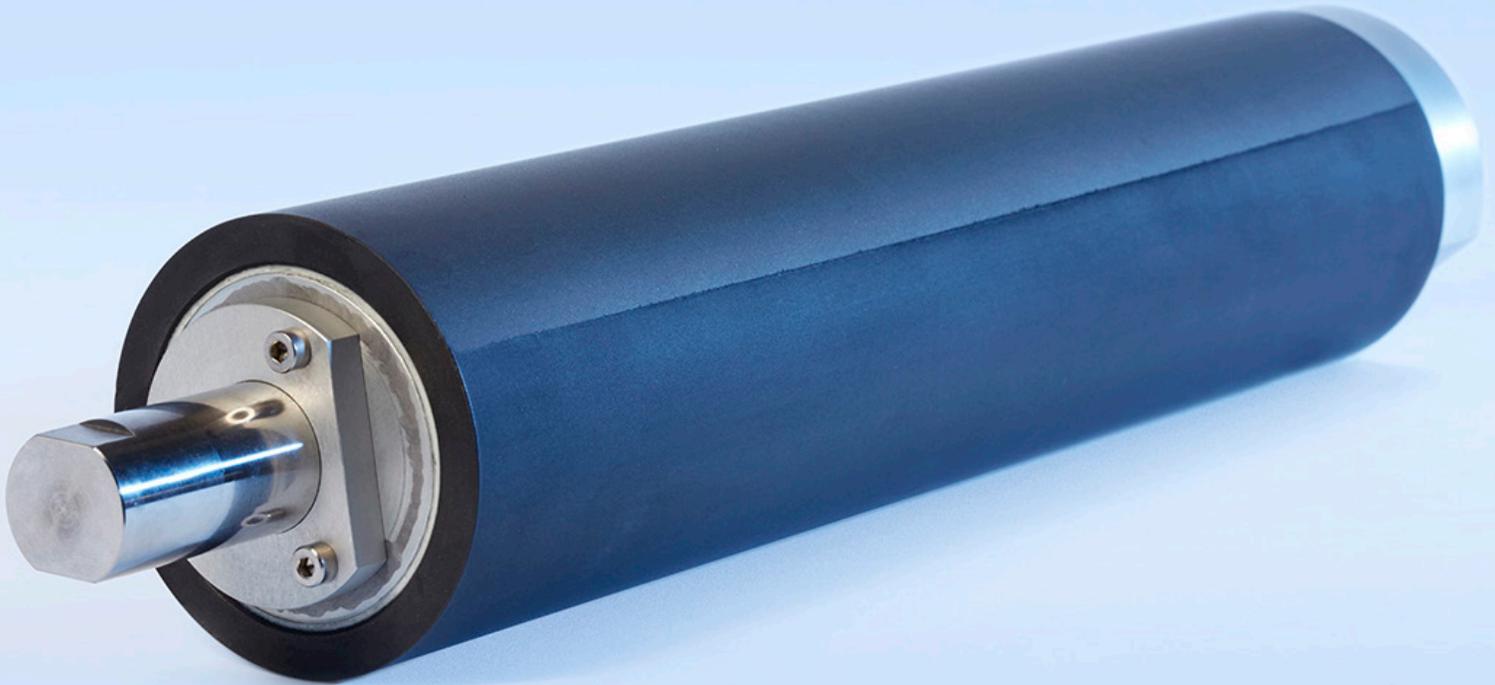
This has given us a good results for our customers, and also why they want to order more.”

Question: What would you say is the biggest reason to work with New Way?

Answer: “Specifically for the air turns, the biggest reason to choose New Way is the technology. The non-contact nature of the product, and the stability and control that it provides, solves so many of the issues with roll-to-roll processing. Add in that the porous media restricts the airflow, so air consumption is very low, reducing costs significantly over drilled-hole air turns. And finally, the flexibility* that New Way offers in customizing your products to fit the footprint of your application. That’s really helpful.”

These would be the biggest reasons to choose New Way.”

*New Way Porous Media Air Turns allows for variance in the film width as it does not require the film to cover all holes like orifice air turns. With orifice air turns, any unused area must be masked off, porous media air turns function optimally, even with uncovered areas, thereby providing even greater flexibility.



Non-Contact Web Handling is the Answer

Consumer electronics and other applications continue their acceleration to increasing sophistication and miniaturization. Increasingly, these R2R production methodologies require active, non-contact handling, especially where concurrent tactical coating operations on both sides of a substrate are required.

New Way has answered the questions that Dirk Smits and his colleagues at IBS Precision Engineering have asked about improving R2R processing for their customers. We'd love to answer any questions that you might have.

When you're ready for a non-contact approach to your R2R application, [contact New Way Air Bearings](#). For more information visit newwayairbearings.com. Or, if you need R2R processing answers PDQ, [contact us](#) directly today for your complimentary consultation!

About Drew Devitt

Drew Devitt founded New Way Air Bearings in 1994 to realize business success through the commercialization of Porous Media Air Bearing Technology. From the time of New Way's founding, Devitt, as CTO, has maintained its research efforts, and its connections with research and academic institutions, in order to foster the continued development of air bearing technology and the dissemination of the knowledge gained. Devitt is a major figure in the world of precision and was elected President of the ASPE for the 2007 calendar year. He holds a Bachelor's Degree in Business Administration.



About New Way Air Bearings

New Way® Air Bearings, Inc. is the world's leading independent designer and manufacturer of modular air bearing products, and the recognized provider of porous media air bearing solutions, sold in over 30 countries worldwide. The company manufactures a standard line of modular, off-the-shelf components as well as custom products, and is ISO 9001:2008 Certified. New Way is headquartered in Aston, Pennsylvania, USA, just 15 minutes from Philadelphia International Airport.

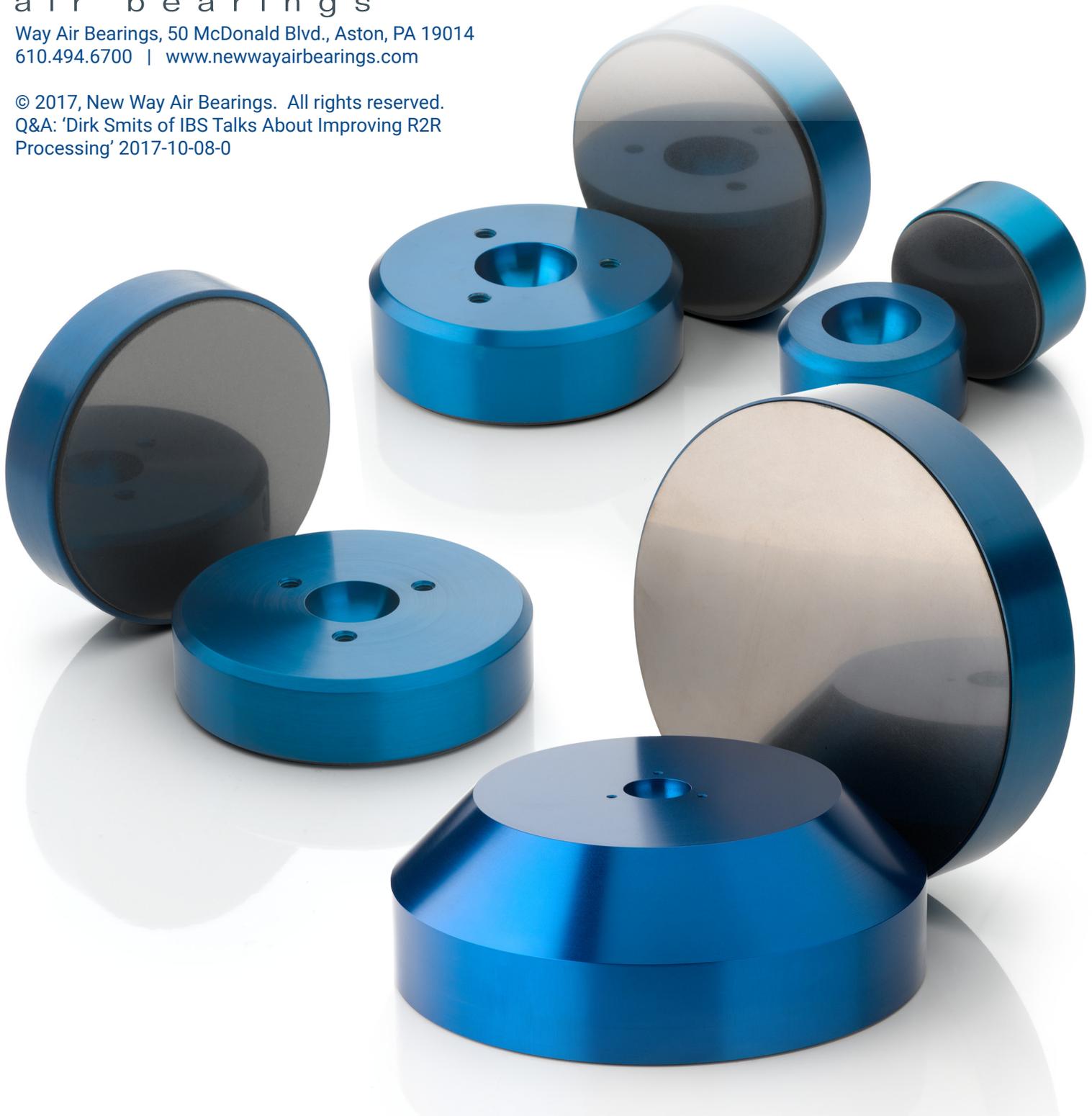


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Q&A: 'Dirk Smits of IBS Talks About Improving R2R
Processing' 2017-10-08-0



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