Plastic ELECTRONICS
Independent Analysis for Organic and Printable Electronics

nTact finds increasing market for slot die coating of organic electronics

John Nelson - 22 Jul 2014

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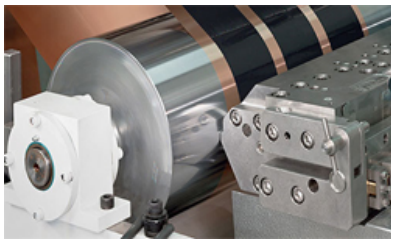
Equipment manufacturer nTact is reporting growing interest for its coating machinery as customers seek to move plastic electronics production from R&D labs into the first stages of commercial manufacturing.

The Texas firm is keen to exploit the benefit of its next generation of slot die coating technology. This can deliver thinner coatings, cheaply in a wide range of applications.

nRad



Two equipment lines are sold by nTact. The nRad machines are compact and optimised for R&D or small-scale production in sheet-to-sheet systems. The nRad series coaters come in two configurations capable of delivering coatings as thin as 10-20nm - one with a maximum A4 (210mm x 300mm) substrate size and a larger version that can handle sheets up to Gen 2 (370mm x 470mm) size.

The average price of an nRad system ranges from $110,000 to $250,000 (€80,000 - €184,000).Such nRad equipment is routinely delivered fully integrated into a sealed glove box system for inert gas processing developed through a partnership with MBraun.

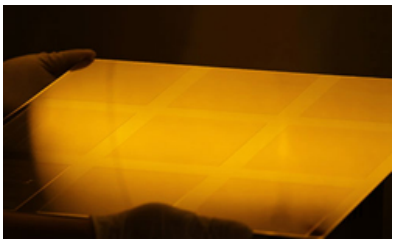
Most recently, nTact has made available modules for the nRad which make the system an ideal platform for roll-to-roll R&D. A timely intervention as a series of roll-to-roll systems for printing electronics, have been unveiled in the past year. The nRad roll-to-roll system has been shown at LOPEC 2014 in May and SID Display Week at the beginning of June.

nDeavor

The second equipment range is the nDeavor. These are production machines capable of sheet-to-sheet coating of substrates between Gen 2 and Gen 8 (2,250mm x 2,500mm). They are robust platforms which can range from $700,000 to well over a million dollars in price.

Depending on the final system configuration, fully integrated nDeavor production work cells can cost several million dollars. Historically these were principally used in LCD production fabs, where the technology was initially developed as an alternative to spin coaters; but nTact has been targeting organic electronics as one of its key future market.

Plastic potential



Miguel Friedrich, vice president of sales and marketing at nTact, explains: 'nTact was the pioneer for developing the use of slot die coating in the microelectronics industry, specifically in the production of LCD panels in the early 1990s. But eight years ago as LCD production moved almost exclusively to Asia, we focussed on new applications such as organic electronics.'

As industry gears up for pilot commercial production lines, the economic advantages slot die machinery can deliver over other coating technologies are coming to the fore.

Compared to vacuum deposition, which has been used in many of the first plastic electronics demonstration lines, nTact machines can operate in a normal or inert gas environment. Friedrich says: 'Slot die coating is becoming more and more popular because it is typically significantly less costly than vacuum machinery. Aside from the actual equipment cost, slot die coating currently has a higher material utilisation rate [typically around 90-95%] which is important as the materials being used for some of these new applications are quite expensive.'

Versatile

Slot die coating equipment can be used with a wide range of rigid and plastic substrates as well as a broad range of materials. Friedrich says: 'Another thing that is very attractive is that the process is very flexible. You can coat organic or inorganic fluids that are low or high viscosity - 1 to more than 10,000 centipoises - on the same equipment platform. All you need to do is change the configuration and a few of the components.'

Pilot production

Friedrich says: 'nTact has seen a lot of activity in lighting in the last couple of years with significant investments in R&D systems. Big organisations are getting interested and they are starting to move toward pilot production.

'OLED displays are a continuing area of interest, with several customers exploring the use of nTact's slot die coating technology to coat elements of the display stack. There is also development work using our coating technology for organic photovoltaic applications, polymer batteries, organic thin film transistors and we believe there is even a scope for biomedical applications.'

A key factor that is buttressing nTact's entry into these markets are the refinements it has made to its slot die coating method to deliver the level of performance required in printed electronics.

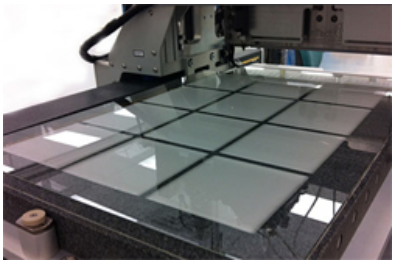
Challenges

Friedrich says: 'The biggest challenge has been the precise control of the coating process at a nanometre level - you may need to go down to 20nm thickness films (dry) for OLED production - as opposed to the micrometre level used for LCDs. With our latest equipment and an optimized coating process, we can give a coating [at that level] with a uniformity that only deviates by 3-5%.'

Selective area deposition

Slot die coating is a proven means to uniformly coat large areas making it suitable for mass production of OLED lighting or cheap organic solar modules. However patterning in deposition to create the clean edges with the necessary precision for printed electronics has traditionally handicapped its deployment.

A further nTact innovation, selective area coating, is challenging this. Friedrich explains: 'Slot die coating has always been very efficient for coating large areas. What we have been able to do in the last couple of years is develop a method for coating an array of rectangular shapes onto the given substrate. We refer to this as nTact's selective area coating or 'patch coating' method. This allows the user to create a pattern of coated areas with very precise control, which is useful in various applications such as lighting.'



By removing the need for masks and additional process steps, costs are lowered - a factor which will be increasingly important as industry moves towards full commercial production. The nTact selective deposition technology is also being developed for applications in roll-to-roll production lines, through a cooperation agreement with the Holst Centre.

The US company has also evolved its own macro-patterning technique using a solvent jet spray removal process to remove material and create more complex shapes or features on the coated area. Although this is not as precise as industry standard photolithographic or laser ablation technologies, it is significantly cheaper. Macro-patterning can be employed to create spaces for circuitry that are a few millimetres wide.

Slot in the market

Having developed its expertise in slot die coatings for LCDs towards organic electronics, nTact is now set to reap the benefits. As it reports customers in multiple plastic electronics segments looking to move from R&D to pilot scale production, there will be an increased focus on cost. This will play to the high yields and high materials utilisation strengths of slot die coaters.

Its versatility, minimal maintenance and set up times will be especially prized as firms enter the pilot production stage. For nTact a key step as these markets matures will be providing its customers with a seamless transition from the nRad platform onto its large nDeavor series of equipment.

As a proven industrial technique slot die coating is well positioned to play a major role in sheet-to-sheet deposition, but developers also needs to examine methods for full integration into high-speed roll-to-roll processes that could ultimately yield the highest returns from plastic electronics.

By John Nelson, follow John on Google+

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