

# Gossamer and Luminous

The production of the future runs in the smart factory. The high-tech company Osram is gradually breathing more intelligence into its plants. With AI, data analytics, autonomous robots – and a 5G campus network.

COPY — Roger Homrich

“**D**etis” bends carefully around the corner. For months now, the small transport robot has been making its daily bread of finding the right shelf, picking up two 50 lb coils there and literally routinely transporting them – because it knows the route – to the neighbouring hall. “Detis” correctly stands for DTS, a small robot, not even waist-high. In the shape of a Driverless Transport System it’s being tested at the Osram plant in Schwabmünchen. The bobbins, which “Detis” almost gently places at its destination for further processing, are wrapped with the finest tungsten. Unlike its small transporter, the refractory metal has been practically at home at Osram for more than 100 years. This is because it is the chemical element with the highest melting and boiling points and is used worldwide in the filaments of lamps.

At present, “Detis” at Osram is literally still in its probationary period. Its use is being tested in Germany’s first dual slice campus network, which combines a public and a private network to form a common infrastructure.

At its plant in Schwabmünchen, the high-tech company Osram manufactures preliminary products for intelligent lighting solutions.



## FACTS & FIGURES

Osram headquartered in Munich, Germany, is a world-leading high-tech company with over 113 years of history. Today's predominantly semiconductor-based products enable a wide range of applications from virtual reality to autonomous driving and from smartphones to networked, intelligent lighting solutions in buildings and cities. The company uses the virtually infinite possibilities of visible and invisible light to improve the lives of people and societies. With innovations from Osram, we will not only see better in the future, but also communicate better, move around, work and live. At the end of fiscal 2018 (ended September 30), Osram had around 26,200 employees worldwide and generated sales of more than 3.8 billion euros from continuing operations in this fiscal year.

The campus network is still based on LTE, the fourth-generation mobile communications standard. With LTE, transmission speeds of up to 300Mbit per second can be achieved, but the latencies are too high for real-time applications at around 30 milliseconds. This will change when the Osram network, which has been built together with partners Fraunhofer and Deutsche Telekom, works with the new 5G standard. The latency time will then drop to a single millisecond that is no longer perceptible.

### **MACHINES AND PROCESSES IN REAL TIME**

“We need the 5G network”, the industry vehemently demanded at the Hannover Messe 2019. Gartner said in a first, not yet representative panel that two-thirds of the companies are already in the starting blocks and plan to deploy the fifth generation of mobile communication as early as next year. For them, 5G is the key to implementing industry 4.0 concepts that pave the way to the smart factory. Driverless transport systems, mobile tools, robots and the interaction of man and machine via AR and VR applications can only be implemented with high-performance radio technology. In Germany alone, digitization in the year 2025 could enable an additional added value of around 85 billion Euros – provided there is a fast and comprehensive 5G rollout by then.

For Stefan Fritz, too, “connectivity is THE topic of the intelligent factory”. Osram’s Vice President Digital Factory is therefore relieved that the three-month frequency auction for 5G is over. “Finally, the expansion of the network can begin. It’s almost embarrassing how long it took the industrial nation Germany for the auction. As with 5G we are long behind.” But not Osram. The company wants to develop its plants into digital factories. And that requires 5G. Because in intelligent manufacturing, all machines and planning processes are networked in real time. “With the Campus solution, we have created an infrastructure at our Schwabmünchen plant that allows us to implement this efficiently and flexibly for future and existing production tasks. The levers are now being shifted to 5G as quickly as possible. And then we can continue with our plans for the intelligent factory.”

### **AGILE PRODUCTION REPLACES THE LINE**

Stefan Fritz has a long-term strategy. For him, the transport robot is just the first step on the road to a smart factory. “Such driverless transport systems are nothing special anymore for a modern factory,” says the mechanical engineer and production technician. “However, so far they have travelled on fixed routes along magnetic stripes in the ground.” This is right for a line production in which products are assembled step by step. “Ford and its line, the revolutionary invention of assembly line production at the time, will soon be obsolete. In the intelligent factory, production is no longer linear. We want to become more agile. It is now a matter of getting small series onto the road quickly and safely, and for this we are moving into modular production, i.e. away from the line to the cell concept,”



T-Systems account manager Dirk Drabnig (left) and Stefan Fritz (right), Vice President Digital Factory, want to expand the 5G campus network.

The autonomously moving transport robot “Detis” transports bobbins with tungsten threads from production to the logistics hall.



says Fritz. For him as an engineer, “smart” means first and foremost more and new productivity. But the companies would have to answer the question: “How do I produce and what do I produce?”

Productivity in Osram’s factories can hardly be increased with the resources available to date. Although there are still small adjusting screws that production experts can turn, “big leaps are difficult to make with conventional means,” says Fritz. This was already the case at Osram 30 years ago, when the great wave of automation roared through the factories. Back then, the Bavarian-based company developed its own control technology including mechanical engineering, as there were hardly any specialized automation specialists for the requirements of a mixed process and product manufacturer.

For Fritz, digitization means raising new efficiencies, even if the increases in the past ten years have not been as large and volatile as before. Everything is highly optimized and automated. It’s faster, the materials have improved further, “which has increased quality and reduced costs at the same time. We have been talking about Industry 4.0 for several years now and have already implemented much of that. The big difference for us is that everything is now networked,” explains Fritz, who with his team examines all facets of the smart factory for feasibility. “We are looking for the productivity drivers, which a McKinsey study puts at three to five percent. These include energy management, intelligent lot optimization, online scrap optimization, reduced downtime and real-time.” This describes Osram’s strategy: “Automation is already very advanced and production has been trimmed to industry 4.0. And now comes the digital factory, where everything interacts: Manufacturing IT, Industry 4.0, lean, mechanical engineering and production concepts in one organizational unit.”

### ONLINE SCRAP OPTIMIZATION IN REAL TIME

As in every manufacturing company, Osram is also concerned with OEE, Overall Equipment Effectiveness. This key figure is an important controlling instrument that uncovers wasted resources: for example, unnecessary transport routes and material movements, incorrect work processes or rejects and rework. OEE key figures therefore systematically show optimization potential. In production, these include malfunctions and breakdowns. But also the quality of individual, sometimes tiny process steps.

How small the production at Osram’s Schwabmünchen plant is shown by the manufacture of tungsten wires for lamps. The shiny white heavy metal is the chemical element with the highest melting and boiling point, which is why it is sintered into rods in a direct current passage of 12,000 amps. The rods are then processed into threads in more than 60 process steps, which can sometimes be thinner than a human hair. “Tungsten shows very well which



The perfect mix makes the difference: Raw materials such as tungsten are mixed with chemical substances to produce the precursors.

small adjusting screws we have to turn in order to increase productivity in production,” says Fritz. And data analysis and real-time will play a decisive role in this.

If there are temperature fluctuations between two process steps during the production of tungsten wires at Osram, for example, this can have an effect on the subsequent process. The quality suffers and rejects occur. “But if we knew that there were temperature fluctuations, we could adjust later steps to reduce scrap,” explains Fritz. Today, the production specialists adjust the machines and only readjust them when they notice that something is changing. “However, if they have the data in real time, for example the exact length of a workpiece, this value is passed on to the next process step, which then automatically adjusts itself to the actual length.”

### OPTIMIZING DOWNTIMES

Productivity can also be optimized by reducing downtimes. Every defective machine costs time and money. “Downtimes can be reduced with a cell concept. If a machine threatens to fail or if we experience a loss of quality, production continues automatically via a different path. To do this, we need data that tells us that”, explains Fritz. Many machines did record data for a long time. But the

question is what to do with the data? “We forward the data to a pipeline. But they still remain in the factory. Process steps are also interesting for other plants, because the process chain does not end at the plant. Osram, for example, processes the prefabricated products from Schwabmünchen in other plants. And customers might also be interested in the data.”

5G does not always play a decisive role in such applications. In many cases, data needs to be processed quickly and fed back to the machine or a dashboard. Telekom has installed a local cloud, an edge, in the campus network. It processes data on site, which increases the speed.

The new standard only plays out all the advantages when it comes to real-time, which is not always the case with data analytics. And it’s about complete information. “Some of our machines are a few weeks young, others 50 years old. We don’t always get the right data. Speed or RPM (revolutions per minute) are good for assessing the condition of the machines. What we need, however, is also temperature or pressure, which give us information about the quality of the products. To do this, we have to retrofit the machines with sensors,” explains Fritz. And it’s about mobility. “Our machines produce a lot of data, which they send via the fixed network. The disadvantage of the fixed network, however, is that it is not flexible. And WLAN is too slow”.

#### IN USE CASES STEP BY STEP

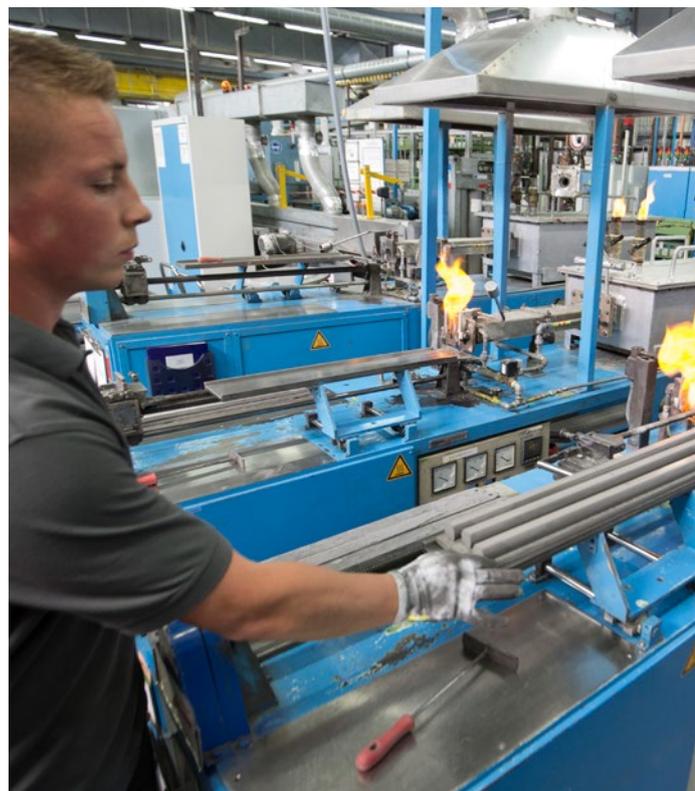
Data and connectivity are the magic words for the intelligent factory to reach the next level of optimization. So big data and data analytics, as well as the speed at which data is processed and results are available, are the big issues for the Smart Factory strategy. “We have the big picture of the smart factory in mind. However, we don’t do everything at once, but define different use cases that we test first. If the result is good, we extend the test to other locations and only then do we implement the solution across the board,” explains Fritz. Osram’s Smart Factory strategy focuses on big data, collaborative robots, traceability and AR applications in individual cases. For Fritz one thing is for sure: “5G will be the connecting element without which most use cases will not be able to exploit their full potential.”

For example, remote maintenance can reduce maintenance costs by up to 50 percent. Osram is therefore testing the use of AR glasses. If there are problems with a machine in Schwabmünchen, specialist staff get virtual help from New Hampshire in the USA. Osram also manufactures LED pre-products there in the small town of Exeter. “Just because HoloLens is hyped at the moment doesn’t mean that AR automatically gives us impact at the moment,” says Fritz. “There are question marks today. The technology is not yet really mature and very expensive. In addition, very large amounts of data have to be processed, for which we want to use 5G again. Then data will be available faster than before.”

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**STEFAN FRITZ,**  
VP Digital Factory, Osram

Osram relies on real-time data analysis in the production process.



Data! Everything revolves around data in the smart factory. And where there is a lot of data, artificial intelligence (AI) also comes into play. This should help to halve quality costs through fewer rejects, rejects and defective products. At Osram, these are in the low PPM range. So there are only a few errors per million units, but product testing is still largely manual. "We will teach the AI to recognize errors that we don't see today. And for this we need computing power and transmission speed. Data input, calculation, results out: That has to happen fast," says Fritz on his way to the next production hall.

### SCALING IS THE BE-ALL AND END-ALL

And there "Detis" bends around the corner again. Fritz is enthusiastic: "This Use Case is a positive example. It brings fast savings and supports our vision of the intelligent factory. We no longer need loops or magnets. And if we have 5G, we can use these mobile robots wherever something has to be transported." The Smart Factory is a scaling issue. The investments would only pay off "if we carry the successful use cases as broadly as possible into the company". When 5G is running, the team sets up the next use case: Autonomous forklift trucks on the outside. "There's a lot of cost-saving potential in this. If the machine tells the forklift truck "don't need to come, be serviced", it saves money and time".

Osram is reinventing itself due to the change in technology, says Stefan Fritz. Not only through new technologies with which light can be generated. "The entire production technology and its processes and procedures are changing. We optimize through intelligence and connectivity. The machines are stupid. Only software and AI make them intelligent. And 5G is the backbone. That means Smart Factory". But that is still not enough for the machine builder. Smart Factory is only 70 percent technology. "The rest is mindset. Because the intelligent factory means cultural change that everyone has to go through: the management, the skilled workers, the suppliers and the partners."



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The digital factory will further increase efficiency, reduce waste and further improve the already high quality.

## MORE THAN LAMPS FOR LUMINAIRES

Osram is highly innovative and is on its way to becoming a photonics champion. This benefits crop, motorcyclists or major events like the Eurovision Song Contest (ESC). For example, Osram has developed a light that researchers and modern farmers can use to develop new, plant-specific light and growth recipes that will later stably produce the desired properties such as quality, quantity and ingredients. LED light modules from Osram can be retrofitted in various models from a motorcycle clothing manufacturer to improve visibility at night and in fog. And as the lighting partner for the ESC music spectacle in May of this year, Tel Aviv was not only home to a large proportion of the moving spotlights in Osram's international congress center. Thanks to Osram floodlights, Tel Aviv's sights also shone in bright colors aside from the ESC stage.