



# Inovan Case Study

Simplifying the design and production of venturi nozzles for reel-to-reel electroplating





### CHALLENGE

Founded in 1952, Inovan GmbH & Co. KG has grown over the decades from a small plant in Birkenfeld to a globally active company with several locations in Germany, China and the Czech Republic. Inovan supplies various branches of industry, from the automotive and electrical industries to the ITC industry, with complex electromechanical components, contact materials and mechanical connecting elements.

One of the most important processes within Inovan's production is reel-to-reel electroplating.



Reel-to-reel electroplating is used to coat solid strips and punched grids as continuous products. In this process, they are pulled through all the required, contiguous processes in one piece. This process is particularly suitable for reducing production costs for large quantities.

To separate the individual processes from each other, the belts are blown off with compressed air. As compressed air is one of the most expensive operating materials in production, the aim is to achieve savings while at the same time increasing the blow-off effect. This endeavor is achieved by the so-called Venturi effect.

The Venturi effect, in which the cross-section of a smooth piece of pipe is narrowed, can increase the blow-off performance and at the same time reduce compressed air consumption, as surrounding air masses are specifically accelerated in the direction of the nozzle's orifice by the resulting negative pressure.

However, the development of a Venturi nozzle is anything but simple. In order to achieve maximum efficiency, such a nozzle undergoes many iteration processes in which prototypes with different hole diameters, lengths, venturi opening shapes, injection shapes and much more have to be compared with each other.

However, the production of such nozzles using conventional, subtractive methods is also very demanding and cost-intensive, as the internal structures that control the flow of air and media can only be produced by reclamping and possibly changing the machine.

It is therefore not surprising that Inovan set its sights on additive manufacturing. The greater freedom in the design of structures, especially with internal geometries, as well as the ability to produce multiple geometries in one printing process, make additive manufacturing ideal for such an application.

However, another property is essential to make a Venturi nozzle suitable for reel-toreel electroplating - a high resistance to chemicals, as aggressive process media are used in electroplating.

Inovan turned to PartsToGo GmbH, a 3D printing service provider with industrial capacities and a special focus on the customer-oriented implementation of 3D printed components, to have their project implemented exactly according to their ideas.



Old CAD design of the Venturi nozzle for subtractive manufacturing



#### Customer

Inovan GmbH & Co. KG

#### Product

Evonik INFINAM® ST 6100 L

#### Pros

- Massively reduced iteration times
- Fantastic mechanical properties
- 55 % higher compressed air efficiency

#### Learn more:

www.production-to-go.com

### SOLUTION

Despite the uniqueness of the project, PartsToGo GmbH quickly identified the right material. Evonik INFINAM® ST 6100 L was chosen due to its excellent mechanical properties, including very high tensile and impact strength and exceptional resilience, as well as its chemical and heat resistance.

In combination with the ultra-fast Nexa3D® XiP photopolymer printer, 50 nozzles can be printed in just 120 minutes. The cleaning effort is very low and no mechanical post-processing is required, apart from the removal of support structures.

The entire printing process, including cleaning, post-processing and curing, takes just 7 hours, with no human interaction with the components for over 2/3 of the time. This exceptional production speed means that the iteration process can be accelerated many times over.

For example, the geometry of the thread had to be adjusted in order to perfect the fit. What takes several days with the conventional method can be done in just 24 hours for PartsToGo GmbH.

This shortened iteration time means that the subsequent test processes for the components can be completed more quickly and many more test processes can take place in the same time. Such intensified test processes facilitate the exact adjustment of components to the application conditions and enable the early detection of potential faults and difficulties of the component.





Not only are the reduced times impressive, the results are also completely convincing. For example, the nozzle opening achieves the target geometry almost exactly with 3D printing – the deviation is only approx. 0.003 mm.

The compressed air efficiency of the 3D-printed component not only reached the target value, it even outperformed the CNC-milled nozzle by a total of 55%. In particular, the contact pressure was increased from 20g to 34g at a distance of 200 mm.

In order to put the chemical resistance of the INFINAM® ST 6100 L to the test, the nozzles were subjected to various exhibition tests. The nozzles passed the tests with the following chemicals:

- Electrolyte with methanesulfonic acid
- Stripper with potassium hydroxide
- Solvent with isopar

Last but not least, the costs are of course an important factor in justifying the additive manufacturing of components. Even if a Venturi nozzle has a life cycle of 2 - 4 years, between 250 and 300 such nozzles are required for each electroplating system, which makes regular re-production necessary.

The cost of a Venturi nozzle using conventional manufacturing methods is approximately €7 per piece. The aim was not to exceed this cost per unit under any circumstances.



Nozzle opening of the 3D-printed part

However, it quickly became clear that this target would even be exceeded. Instead of even coming close to €7 per piece, PartsToGo GmbH only charges €3.87 per component, even for a small batch size. This means that the last potential stumbling block for the additive manufacturing of venturi nozzles has not only been removed, but virtually pulverized.



The use of additive manufacturing and the Evonik INFINAM® ST 6100 L simplifies and reduces the cost of both the development and production of the complicated Venturi nozzle - and Inovan has found a competent and long-term cooperation partner in PartsToGo.

## TESTIMONIAL

"The customer service and project-related collaboration at PartsToGo is excellent. I look forward to tackling further challenges together in the near future."

PATRICK ASSFAHL Product Manager at Inovan







### INFINAM® ST 6100 L

INFINAM® ST6100 L sets new standards in the category of high-strength photopolymers with a combined tensile strength of 89 MPa, a flexural stress of 145 MPa and an HDT of 120 °C. It closes the material gap in the ultrahigh-strength photopolymer category. It thus closes the material gap in ultra-high-strength photopolymers. These properties make ST 6100 L the material of choice for applications that require high temperature and chemical resistance in combination with high mechanical strength.

Learn more at: www.production-to-go.com



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