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Solukon Digital Factory Tool: Solukon launches a Sensor and Interface Kit for the Digital Thread and Quality Validation

Augsburg – Since launching the market’s first automated depowdering system, the SFM-AT800 in 2015, Solukon is the known pioneer and expert for powder removal. Being pioneer in the field of postprocessing means taking into account other steps of the process chain in Additive Manufacturing, too. Therefore, Solukon has fine-tuned a sensor concept and launched an interface management concept in order to fit Solukon depowdering systems into a holistic AM process chain. This is an exemplary and crucial step towards fully integrated automation and quality assurance in Additive Manufacturing.

Additive Manufacturing has undeniably grown very rapidly over the past years. That may be one reason why connecting different parts of the process chain (like the printing job itself, depowdering or removal of support structures) was off the radar with leading OEM’s and service providers. But connectivity throughout the whole process chain might be the turning point on the way to fully automated Additive Manufacturing. This is where Solukon comes into play, fulfilling its role of a pioneer for automated postprocessing: Solukon launches an interface management concept, the Solukon Digital Factory Tool, to support a holistic approach of the AM process chain.

Solukon SPR® Technology: State of the Art in Depowdering

Depowdering is a weak link in the metal AM process. The issues faced by users include the risk of explosion, occupational health, labor costs, powder recovery, cleaning quality and process repeatability.

Solukon tackles these issues with the unique depowdering technology SPR® (Smart Powder Recuperation). Solukon systems remove loose powder from metal laser melted parts within a sealed process chamber, using adjustable vibration and automated two-axis part rotation. Through programmable rotation of the build-plate in two axes, unfused metal build material is completely removed from complex channels and geometries. This means a significant increase in efficiency, security and quality while saving costs.



Quality Management and Regulations in Postprocessing

In AM the demand for even faster and safer production processes is on the rise. Yet, quality management plays a more important role as well. Manufacturers are forced by regulations and standardization to rethink their production processes both concerning accuracy and repeatability of the build job itself and concerning the production line as a whole.

Various norms and regulations are relating to postprocessing. Industries like Aerospace or Medical are the pacemakers in implementing standards.

Well-known examples are:

- *ASTM F3335* for medical products,
- *Technical Considerations for Additive Manufactured Medical Devices* (FDA),
- *MSFC-STD-3716*, standard for Additive Manufacturing in Aerospace,
- *and the German VDI guideline 3405 (Additive Manufacturing in general)*.

Solukon as Pioneer in Automation

Automation in postprocessing has been an issue for Solukon ever since. As in 2018, when Solukon cooperated with Siemens to develop SiDAM software which is based on a digital twin and a flow simulation algorithm. With the help of this intelligent software, the most complex parts, such as heat exchangers, can be moved along any complex inner channel and emptied in a safe way. As a result, cleaning results are reproducible, modifiable and safely automatable. The SiDAM project of Solukon and Siemens received the tct award 2019 (category post processing).

Now, Solukon brings automation to the next level: Solukon has fine-tuned its sensor concept and launched an interface management concept in order to fit the depowdering process into a holistic digital production environment. This will increase efficiency and ensures a continuous quality control.

The Solukon Factory Tool in detail

The Solukon Digital Factory Tool allows an easy integration of automated powder removal into an overall digital AM process.

The tool includes:

- production control
- maintenance management
- integration of automation and
- process validation / quality management.

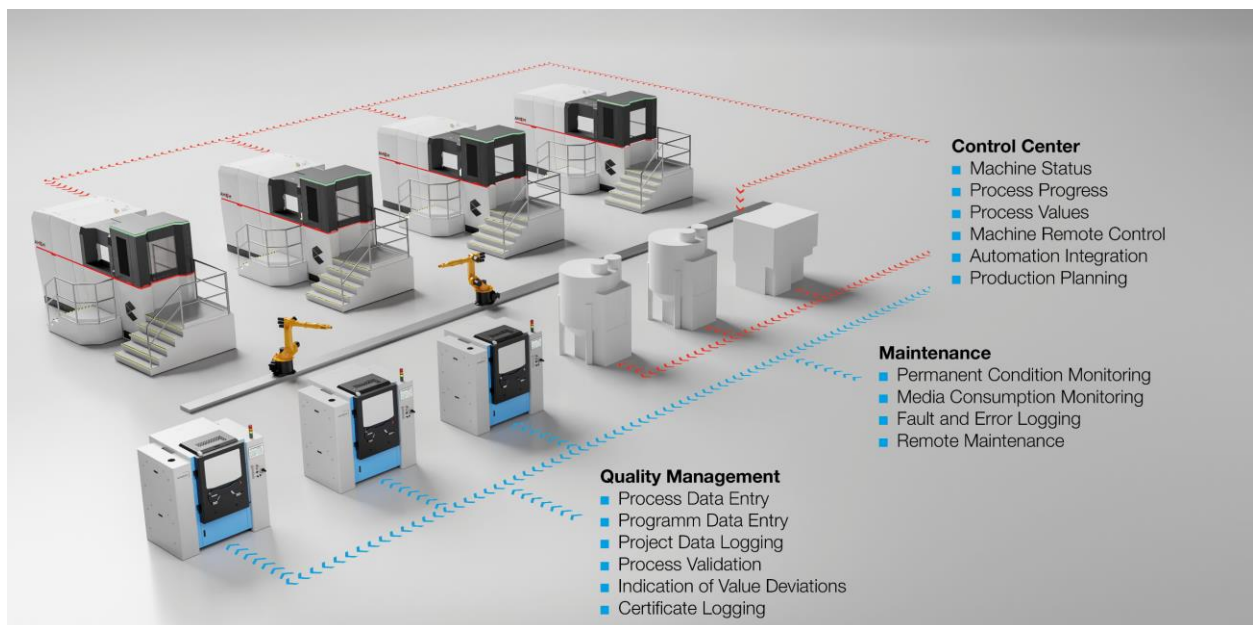


Figure 1: Overview of the Solukon Digital Factory Tool

These aspects are further discussed in the following.

Production control

Since 2017 Solukon has equipped the SFM-AT800 with an OPC-UA interface to enable central controlling and monitoring.

Like at Fraunhofer Institute for Machine Tools and Forming Technology (IWU) located in Dresden, Germany, where a Solukon SFM-AT800 with an OPC-UA interface is part of a modular robot cell. This fully automatic robot cell serves as a characteristic example for downstream processing: Besides the Solukon depowdering unit the robot cell consists of

a system for optical analytics of the geometry and a system for support removal. The different stations communicate via OPC-UA.

Part loading and further tasks referring to metal cutting are performed by the robot.

“Remote controlling the Solukon-system via OPC-UA ensures a flexible and adaptive part processing. As this entire process runs automatically, we are saving much adjustment time and therefore are ready for further functional integration, state Dr. Juliane Thielsch, department manager of “Laser Powder Bed Fusion” and Dr. Arvid Hellmich, department manager of “IIOT-Controlling and Technical Cybernetics” at IWU Dresden.



Figure 2: The Solukon system in a modular robot cell at Fraunhofer IWU. Credit and copyright: Studio36 Berlin.

The rise of Additive Manufacturing in industries like Aerospace brought up factory lines consisting of a variety of 3D printers and peripheral equipment.

All of these devices are covered in one central control station. This is where production managers are able to monitor and control the machines. Therefore, both upstream and downstream processes like set-up effort, unpacking, depowdering and sieving can be connected and monitored in real time – regardless of the printing job itself.

In order to ensure efficiency in production planning one major focus should lie in production coordination. The machine data collection supplies data concerning operating time and shutdowns and therefore essential information with regard to overall equipment effectiveness (OEE) for further production planning. For planning, the operator is usually



using apps, wherein data is collated and summarized in dashboards. Afterwards the operator may consider a planning software for evaluation.

The Solukon OPC-UA interface allows both access to machine data and remote control. In addition, the Solukon Digital Factory Tool enables the operator to integrate all information into the dashboard of the machinery app. Data and parameters referring to cleaning programs, such as running time and batch number, can easily be assigned via the network. Regarding the cleaning process the OPC-UA interface enables the operator to start, monitor and modify the cleaning program as desired. Machine state and process progress are accessible in real time.

Maintenance Management

Solukon's new sensor system monitors all sensitive machine components and processes referring to lifetime of the machine.

The operator therefore can immediately recognize unwanted changes in consumption of inert gas, compressed air, chamber atmosphere or energy to get an overview about the performance of the individual machine components. Moreover, the system informs the operator in time, when maintenance is required or when to procure wear parts. Upon request, Solukon sets up an interface for remote maintenance and diagnosis.

Integration of Automation

Flagship projects like HyProCell and NextGenAm issue an outlook how automated AM-production works. Integration of downstream processes in particular will play an increasingly important role.

At HyProCell, Solukon has already proven his competence in automation integration: The Solukon system SFM-AT800 is constantly communicating with a control center while being loaded by a robot. For this purpose, the SFM-AT800 has been equipped with a special loading door and an automatic clamping system.

"The Solukon system is the first unit right after the building process and is therefore essential for further steps of the automated process chain. With the Hyprocell project, Solukon impressively displayed their high automation potential. Therefore, Solukon systems are ideally suited for further automation projects", states Dr. Juan Carlos Pereira Falcon, Senior Researcher at Lortek and coordinator of the HyProCell project.



Process Validation and Quality Management

The extended quality feature is obviously the key element of the Solukon Digital Factory Tool.

Certification is a big but mandatory challenge for manufacturers of sensitive industries like Medical or Aerospace. Each step of production is supposed to be clearly reproducible. The more process data is recorded and logged, the easier the certification.

The Solukon Digital Factory Tool provides a fine-tuned sensor package to record relevant conditions in the process chamber, such as residual oxygen, humidity, pressure, temperature and frequency of the vibrator, in a protocol file for quality assurance. Effective evaluation of the recorded data helps validating the process in an overall quality certificate and simplifies process optimization. The operator may set limits to sensible values in advance so that deviations are noticed and considered immediately and quality defects are avoided in time. Beside process data even information referring to the cleaning program itself are recorded automatically.

To create a certification document for each project, the user has the opportunity to fill out a large and individual composable input mask.

The user then can collect data referring to his build job in a flexible dialog box. This includes for example type, batch and used material. In the end, the user is provided a final protocol as PDF- CSV or XML-file to be stored central or printed on paper.

In summary the Solukon Digital Factory Tool raises quality management to the highest level: It provides continuous documentation and real time monitoring.

In this way the complete process step is fully recorded and can be resubmitted for proof of quality. Problems and quality deficiencies can easily be identified in time and their cause revealed.

„The Solukon Digital Factory Tool marks a significant step towards automation in postprocessing and therefore towards integration into a holistic AM process chain. Especially through process validation in one comprehensive protocol our customers achieve an even faster, more accurate and easier certification. The Solukon Digital Factory Tool is especially applicable to sensitive industries like Aerospace and Medical“.



Figure 3: Alexander Bauer, Application Manager at Solukon

Solukon will offer the Digital Factory Tool as a new option for the SFM-AT800 and the SFM-AT1000-S. Existing SFM-AT800-S systems can also be retrofitted upon request. Solukon is currently cooperating with two leading manufacturers concerning process integration. Results of these projects will be presented soon.

On March 30, Solukon launches a webinar on the subject of automation. Learn more about the Solukon Digital Factory Tool and the Digital Thread and register now: www.solukon.de.



About Solukon

Solukon Maschinenbau GmbH is a German high-quality supplier of powder removal and processing systems for metal and polymer Additive Manufacturing. Founded in 2013, the company, located in Augsburg, Germany, has extensive experience in the development of AM systems and related peripheral equipment, and offers a full range of industrial powder processing systems. Solukon products meet the highest functionality and safety standards and are approved for safe and reliable removal of tough-to-handle and reactive materials such as titanium and aluminum.

Solukon is present on four continents. The systems are trusted by leading manufactures of 3d-printing systems, like AMCM, by institutions like NASA and CERN as well as by companies like Siemens and ArianeGroup.

Solukon Maschinenbau GmbH

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