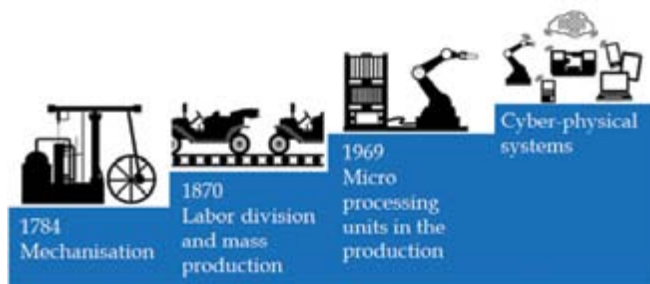


Industry 4.0 Meets Shot Peening

INDUSTRY 4.0 is the German vision for the future of manufacturing, where smart factories use information and communication technologies to make huge benefits in the form of improved quality, lower costs, and increased efficiency. Cyber-physical systems communicate and cooperate with each other and humans in real time through the Internet of Things. Via the Internet of Services, both internal and cross-organizational services are offered and utilized by participants of the value chain.

The required automation technology is improved by the introduction of methods of self-optimization, self-configuration, self-diagnosis, cognition and the intelligent support of workers in their increasingly complex working environment. Involved components actively communicate with each other and are equipped with Artificial Intelligence. Decentralized decision making by cyber-physical systems within Smart Factories help create intelligent object networking and their cooperative organization will coin the industrial production of the future.



Evolution and revolution in production

However, how can Industry 4.0 be applied to shot blasting processes? Step by step, components of shot blasting machines are equipped with highly flexible automation technology. To begin, the RUMP refill hopper is the newest solution for automatic dosage of abrasive, making it an effective way to ensure shorter and more reliable working processes. By permanently communicating with the blasting unit, the replenishment unit avouches a constant abrasive level of different sized steel shot with optimal distribution, which in return leads to significantly more reproducible blasting results on the treated surface. Additionally, thanks to the optimized effect of the blasting media, the blasting process time is reduced by 5-10%.

Avoid Costly Process Instabilities

Often the refill process is done manually and is therefore

operator dependent, which, due to the human input, may not always be consistent. However, replenishment is done when the amount of abrasive is at a critical level or the blast wheels lack supply of abrasive, but certainly not permanently. As a consequence, the operating mixture is very fine before replenishment and afterwards very coarse and without any midsize abrasive.

A shot blasting operation that goes too long without new abrasive replenishment leads to a reduction of the average grain size and lowering of the bunker level. That greatly extends the shot blasting process, because the lack of coarse abrasive also lacks sufficient kinetic energy to remove scale deposits or sand scabs. The roughness of the blasted workpiece decreases.

Consequently, large amounts of new abrasive must be topped up and the distribution of the abrasive mixture shifts completely in the other direction—hardly any fine abrasive, and too much coarse abrasive. The shot blasting process is extended until the necessary surface coverage is reached. The roughness of the blasted workpiece is high.

The RUMP refill hopper was developed to solve these fluctuations in the abrasive mixture and the process results, respectively. It is directly linked to the control of the blasting system and provides new abrasive into the cycle so that the particle size distribution remains constant. The fill level monitor reminds the operator at right time to add a full bag of abrasive. Then the system is filled manually by pouring a complete bag of steel shot into the hopper. The refill hopper unit can be installed on virtually any blasting machine easily and with little effort. It can be situated in any optimal space where it can be refilled with ease. When doing so, the supply tube is simply connected to the abrasive circulatory of the shot blasting machine.

Conclusion

Maintaining a constant operating mix means making sure the hopper is full. And while new abrasive must be added regularly to the mix, the amount of new material added at one time should not be too much to avoid extreme fluctuations. The ability to abide by this principle actually produces a marked effect on the overall profit.

Also, the size distribution of the abrasive particles is a key factor in the quality of the surface preparation achieved by the abrasive, and should be checked regularly and kept constant. The use of smart technology therefore provides essential advantages to optimize the effect of the blasting



Fully automated dosing unit

media and helps ensure high quality of surface treatment. The reduction of the working process time implies a reduction of the production costs. It likewise improves the operating safety of shot blasting machines and paves the way to more effective shot blasting while using fewer resources.

Further Steps

At RUMP, we aim to use Industry 4.0 technologies for the upmost benefit of our customers. Therefore we install modems in the shot blasting machines which allow remote support. The shot blasting machine communicates its current status and whenever preventive maintenance or technical service is required, our service team is informed.

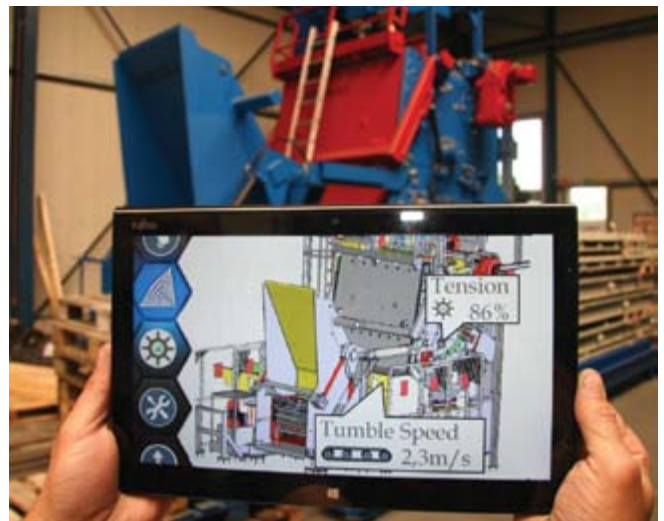
However, the technology of the future may go even further than this. We understand that improvements in the production process require data which can then be used to detect faults and failures. Accordingly, we aim to offer high-end quality service enabling the shot blast machines to make a **self-diagnosis**. Doing so, the machine gains the ability to predict failure and trigger maintenance processes autonomously. In other words, it knows when to replace

a wheel or automatically orders new abrasive. The self-awareness of the components provides the management with more insight on the status of the factory and the current operating conditions.

Another future feature is the **self-configuration**: The shot blasting machine may carry out automatic readjustments concerning the object that is to be blasted. It recognizes the shape, weight and material of the object and performs individual fine-tuning and therefore adapts the abrasive mix and the trajectory in order to optimize the blasting result. Alternatively, this data may be provided by the production system. This may greatly contribute to the efficiency of the internal logistics, as the machine can react immediately to unexpected changes in production.

Thus, intelligent support and the provision of worthwhile data is a key factor to reach just-in-time maintenance and gain zero downtime. Nonetheless, a big challenge of Industry 4.0 is and will remain the reduction of complexity of production systems and processes. Increasing functionality, customization, dynamism and cooperation between production systems make manufacturing more and more difficult to handle and to organize.

Accordingly, the only way of managing this density of individualized industrial production will be implementing decentralized control mechanisms such as more and more autonomous shot blasting equipment. In this regard, modelling plays a key role in managing highly sophisticated technological systems. Appropriate models and IT systems should be deployed in order to provide end-to-end support to the entire value chain. With RUMP and Industry 4.0, the increasing complexity of manufacturing processes will become manageable for the people who work there and a simultaneously attractive, sustainable and profitable production will be ensured. ●



Control panel for a tumble machine