

Trends in Automotive Parts Cleaning

The current megatrends in the automotive industry, which include Industry 4.0, electric mobility and autonomous driving, will all have a significant impact on parts cleaning. In the past the focus has been on removing particles, but now contamination in the form of films of oil or grease is taking centre stage.

Gerhard Koblenzer

The automotive industry is the world's largest customer for industrial cleaning machines. In the past, the manufacturers of these machines have put the emphasis on raising standards of cleanliness. This began with the introduction of anti-lock braking functions (ABS) and new injection systems in the 1980s. The development of more and more powerful and compact engines and gearboxes has also led to a growing demand for cleaning machines that can reliably meet specific particulate cleanliness standards. In addition, new materials, such as lightweight metals, have been introduced into the automotive industry and subjected to a variety of different machining processes.

Over recent decades, all of these trends have resulted in parts cleaning processes

that focus on the removal of particles. Film-type contamination generally only came under consideration during the pre-treatment of surfaces for painting or powder coating. It also played a functional role as a treatment before or after thermal processes.

One exception in recent years has been the preparatory processes for welding, which have become more important as a result of the use of lightweight metals in vehicle bodies and the growing level of automation in some production lines. In particular in the case of aluminium, the quality and strength of welded joints are heavily dependent on the cleanliness of the surfaces and specifically on the removal of film-type contamination.

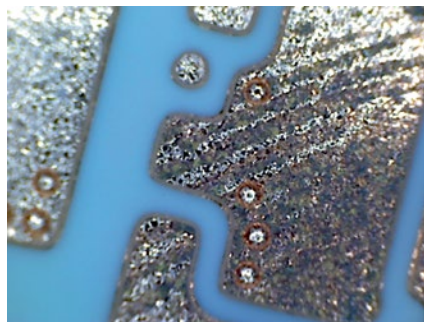
Technological trends and their impact on cleaning systems

These tasks will remain important considerations for the industry, although it is likely that their scope will differ. However, they will be accompanied by new trends which will bring about increasing changes in the requirements for parts cleaning processes, such as the restructuring of production processes on the basis of the principles of Industry 4.0. This will include networking industrial production with modern information and communication systems with the aim of establishing flexible and versatile processes that can respond to more volatile market con-

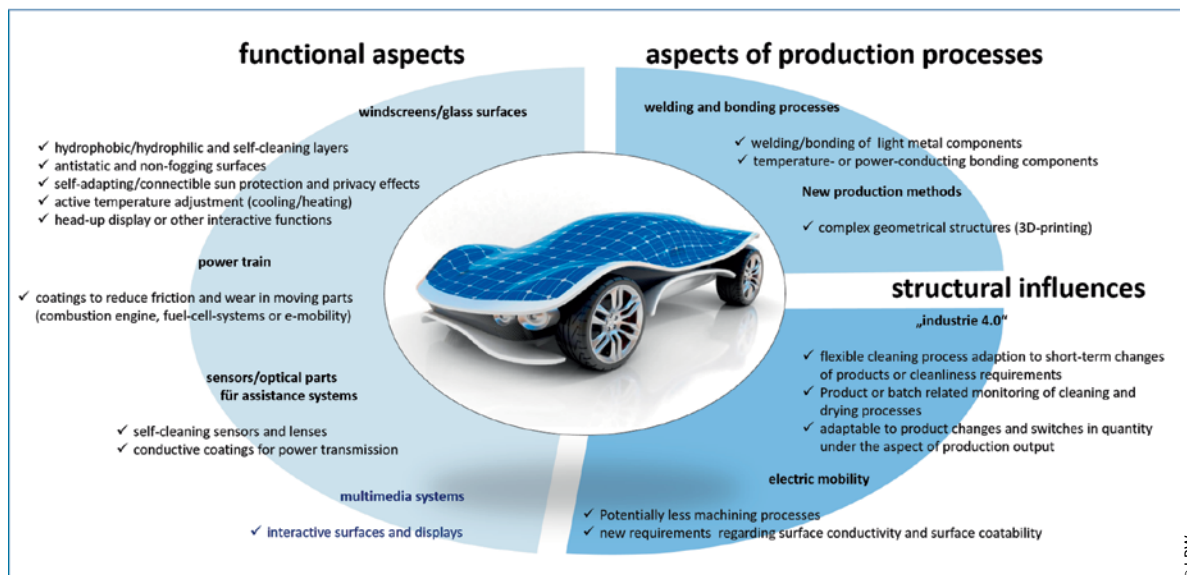
ditions and ultimately manufacture smaller quantities of products cost-effectively, even down to a batch size of one. This trend will also make an impact on industrial parts cleaning.

In addition, the latest technological developments, including the increasing electrification of the powertrain, will have a major influence on parts cleaning. The integration of electric motors and fuel cells into vehicles will lead to the introduction of additional and quite different manufacturing and assembly tasks into everyday production activities. Machining processes will become less important, while at the same time new requirements will be introduced in many subprocesses, including the conductivity of components, the continuity of control currents and the suitability of surfaces for coating, bonding and welding.

Autonomous driving will also result in changes to parts cleanliness standards. Current assistance systems, which have a large number of optical sensors, involve many different precision cleaning phases, particularly in automotive industry suppliers' production processes. The introduction of autonomous driving will require high levels of fail-safety combined with redundant safety systems. The components and assemblies used must meet the highest standards of cleanliness in terms of both particles and, in particular, films of contamination. In addition, the production process must be fully traceable and auditable.



Fine organic and inorganic contamination on conductive surfaces requires suitable high-tech cleaning solutions.



Development trends with direct influence on industrial cleaning processes.

One side effect of autonomous driving is that the vehicle occupants will have nothing to do. The need to entertain and occupy them will call for more high-tech multimedia and connectivity solutions than has been the case in the past. The installation of interactive screens, including the use of existing displays, will result in the surfaces having to be prepared for the application of functional coatings, for example. This in turn will require the introduction of high standards of technical cleanliness. In addition, vehicle air conditioning systems are increasingly using air filters and heat exchangers with a fine capillary structure. Ensuring that electronic assemblies continue to function correctly also demands higher levels of cleanliness.

New production processes

An additional, if less noticeable, trend with an impact on cleaning processes is the production of complex three-dimensional structures using 3D printing. The resulting products often have open-pored structures with areas that are difficult to access, which will make it hard to guarantee that specific cleanliness standards have been met. In addition, the demand for adaptable and flexible manufacturing processes in many areas may make it more difficult to manufacture items on production lines. Versatile subprocesses, in some cases located in individual manufacturing cells, will also represent a challenge in future with regard to

technical cleanliness. It is not only the machines that will need to be modified. The employees' qualifications, their basic knowledge and their understanding of technical processes will become increasingly important. Simply adhering to pre-defined parameters will no longer be sufficient.

Factors that influence the production of industrial cleaning machines

The trends described here indicate that the market is undergoing significant changes. Cleaning components after machining and removing large quantities of particles and swarf will remain important, although it is hard to say to what extent. However, new requirements and processes will also be introduced. The mass production of identical or almost identical components in large quantities with short cycle times on traditional production lines will be accompanied and, in some cases, replaced by highly flexible manufacturing cells involving a significantly wider range of cleaning tasks.

Removing contamination in the form of films, cleaning capillary structures and preparing surfaces for welding, coating and bonding processes will require increasingly complex processes. It must be possible to make use of appropriate chemicals, suitable cleaning methods and customised drying functions for each type of component and to document every stage of the process.

Manufacturers of industrial cleaning machines need to accommodate these requirements as quickly as possible. Experience of the medical technology, semiconductor, optical and aviation industries could be very useful in this respect. Improving technical cleanliness standards in production processes is extremely important in particular with regard to fine particles and films.

Machine manufacturers that have not only demonstrated their expertise in the automotive industry, but have also acquired experience of providing high-quality cleaning solutions for the removal of particles and films in other industrial sectors will cope comparatively well with the changes described above. This applies in particular to well-established, medium-sized specialist companies that can design and produce machines to provide technical cleaning processes. //

The Author

Gerhard Koblenzer

Managing director
LPW-Reinigungssysteme GmbH
Riederich, Germany, Tel. +49 7123 3804 0
info@lpw-reinigungssysteme.de
www.lpw-reinigungssysteme.de