Checking technical cleanliness using a Surface particle counter with glancing light technology

Working in an environmentally sustainable way is a central issue in our society. The development of many parts and components is being pushed towards ever less material use and ever smaller structures. Accordingly, the components are becoming more sensitive, so that the requirement for component cleanliness is increasing in order to ensure reduced quality issues. When it comes to component cleanliness, a distinction must be made between technical cleanliness and optical cleanliness. Technical cleanliness refers to contamination that is critical to functionality, while optical cleanliness refers to contamination that impairs the visual appearance.

The standard VDA 19, known from the automotive industry, and the ZVEI "Guidelines for Technical Cleanliness in Electrical Engineering" developed from it are a helpful tool for assessing technical cleanliness. In the past, particles in the automotive industry were often only interesting when they were at least 50 µm in size. In transmissions and drive shafts, particles in many places are only considered critical from 600 µm onwards.

However, we at PMT are receiving more and more inquiries about how to detect particles smaller than 50 µm. The glancing light technology mentioned in ISO 14644-9 has proven successful. Light is illuminated almost parallel to the surface. Light is reflected and scattered at every elevation. Even particles a few micrometres in size can be reliably detected. The measuring principle is used in practice in the "PartSens 4.0" instrument from PMT (GB) Ltd.

Sample preparation does not require wet extraction. Depending on the surface geometry and condition, the component can be sampled directly, or the particles can be extracted dry. This makes this method ideal for all components that cannot get wet, are stationary or for which wet extraction is not an option for other reasons. It therefore represents a very good alternative or supplement to classic wet extraction and standard analysis according to VDA-19.

Two practical applications will be presented here as examples.

Example 1 is about assessing the cleanliness of rolled metal plates and metal foils. The challenge is to be able to make valid statements about the average contamination in as short a time as possible. This enables reliable identification of negative trends in routine operation, such as increasing particle numbers due to machine wear. Direct measurement on the surface is only suitable to a limited extent due to the rolling structures. Dry particle extraction using adhesive pads is more suitable.

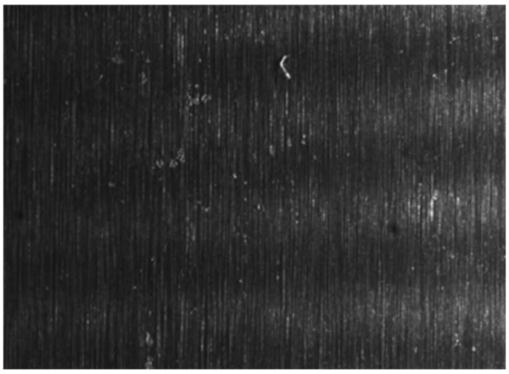

Figure 1 Direct measurement of the component. The traces of processing caused by rolling can be seen.

In order to verify the suitability of the extraction process, VDA 19 requires the determination of a decay curve. The component is cleaned six times in a row in the rinsing cabinet. The number of particles in extraction 6, must not be greater than 10% of the number from extraction 1.

Following this procedure, the component was sampled six times in a row at the same point and a decay curve was determined. As the diagram below in Figure 2 shows, this method can be said to be suitable.

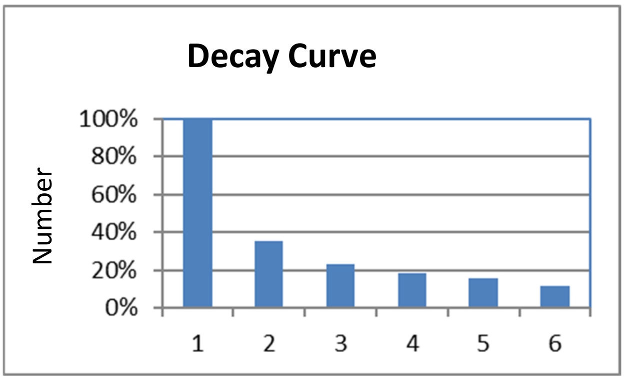

Figure 2 Offset at a predefined point to determine a decay curve (left); determined decay curve (right)

Example 2 impressively illustrates the role of people in clean rooms. Two different workplaces were examined. Workplace 1 was in an ISO 7 clean room with turbulent airflow. Workplace 2 was in an ISO 6 clean room with laminar air flow. In addition, workplace 2 was shielded from the corridor by hanging plexiglass from the ceiling up to about 50 cm above the work surface. This prevents the air from mixing due to staff movements. Furthermore, two so-called ionization strips were installed in the workplace area. An example is the AeroBar 5225 from SIMCO ION. These prevent electrostatic charging of the surfaces and thus the adhesion of particles. Both workplaces were cleaned the day before.

Samples were taken at both workplaces using a contact test. The results show the effectiveness of the measurements. Most of the particles detected are between 10 and 50 µm in size. The number decreases towards smaller and larger particle sizes. Since these are clean rooms, the contamination must have originated in the clean room itself. It is reasonable to assume that the particles found are human skin flakes. Whether and how critical this contamination is ultimately depends on the product manufactured and must be assessed by the QM / QS department.

Particle sizes [µm]		Workplace 1	Workplace 2
ISO 14644-9	< 1	0	0
	1 - 5	27	1
	5 - 10	22	1
	10 - 50	254	4
	50 - 100	11	0
	100 - 500	0	0
	Total:	314	6

Particle sizes [µm]		Workplace 1	Workplace 2
VDA 19	< 5	27	1
	5 - 15	51	1
	15 - 25	81	2
	25 -50	144	2
	50 - 100	11	0
	100 - 150	0	0
	Total:	314	6

Cleanrooms are often equipped with a particle monitoring system for airborne particles. It must be questioned whether the particles detected in the experiment were even recorded by the particle monitoring system. Depending on the damage potential of the particles found, it is worth considering monitoring for particles > 10 µm. A proven solution can be found in VDA 19, which describes the use of particle traps.

The sensitivity and flexibility of the glancing light method was demonstrated using two practical examples, implemented with the portable surface particle counter PartSens+ 4.0.

For more information on the PartSens+ 4.0, please visit www.pmtgb.com or contact us on info@pmtgb.com.