



Fraunhofer

IPA

FRAUNHOFER INSTITUTE FOR
MANUFACTURING ENGINEERING AND AUTOMATION IPA

CLEANLAB – ANALYSES FOR PARTICULATE CLEANLINESS





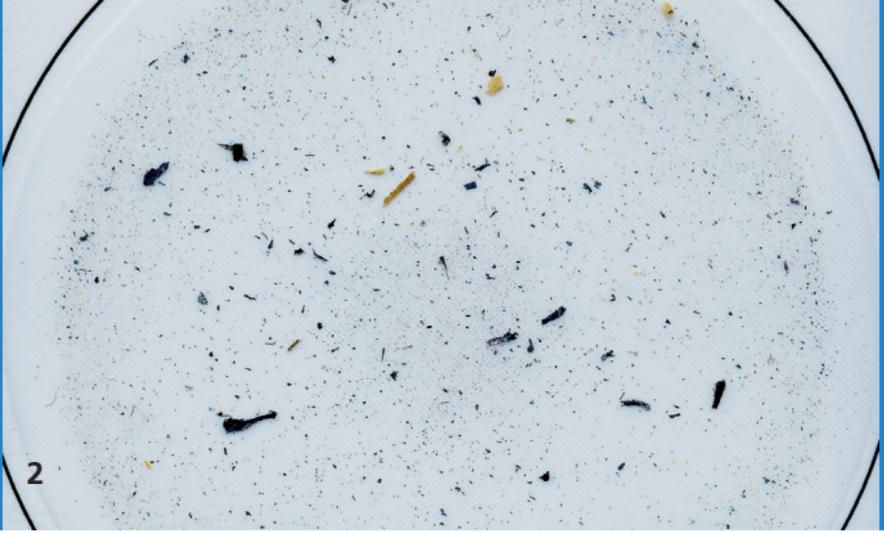
Tailor-made infrastructure

Since mid-September 2013, the range of services offered by Fraunhofer IPA to assess the purity and cleanliness of components, surfaces and liquids has been extended by CleanLab, a cleanliness concept that is unique in the world: a cleanliness-optimized and cleanliness-graded cleanroom concept has enabled the existing cleanroom with a surface area of approximately 200 m² to be linked with the CleanLab laboratories of ISO Class 3, 6 and 8.

Cutting-edge, automated light-optical, fluorescence and scanning electron microscopes as well as micro-computer tomographs supply the best answers to current and future cleanliness issues – from the detection of particles right up to their analysis.

Combined with the institute's long-standing expertise in the field of cleanliness technology, this infrastructure forms the basis of a broad spectrum of research topics, up to and including their application in routine operation for series monitoring.

- 1 *CleanLab extraction area.*
- 2 *Filter membrane used in a cleanliness test.*
- 3 *Medical products sensitive to contamination.*
- 4 *Analyzing the cleanliness of a liquid.*



Technical cleanliness in the automotive industry

CleanLab offers a whole array of possibilities for dealing with analysis issues concerning technical cleanliness, ranging from cleanliness analysis right up to cleanliness-suitable manufacturing:

- Cleanliness analysis by means of extraction using pressure-rinsing, rinsing, ultrasound and agitation
- Analysis of the cleanliness of components sensitive to liquids using ultra-pure compressed air
- Analysis of particle traps to monitor the environment or localize particle sources
- Analysis of particle stamps
- Automated analysis using a light-microscope capable of detecting particles 5 μm and larger
- Automated SEM-EDX analysis
- 3D particle analysis using a micro-CT
- Correlative analysis
- Training course to become a technical cleanliness inspector
- Training course to become a technical cleanliness planner

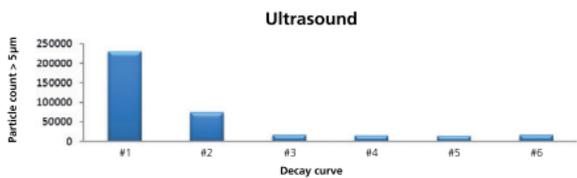
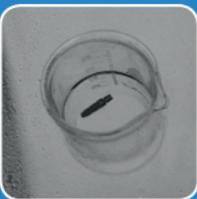
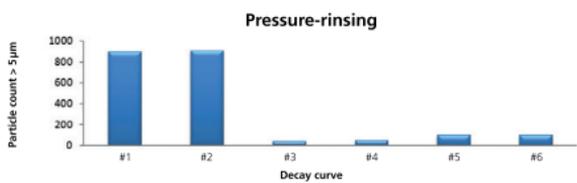
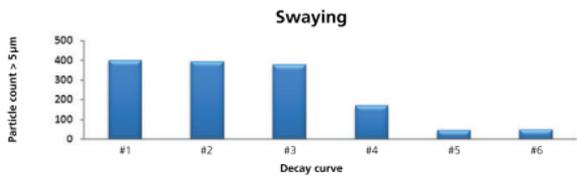
Validating the cleanliness of medical and even space products

For numerous other products manufactured in industries ranging from medical technology right up to space travel, there are special requirements as far as particulate cleanliness is concerned.



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Thanks to the adapted cleanliness concept, analytical equipment and long-standing know-how in cleanliness technology, these issues can now also be dealt with in CleanLab. Here, appropriate sampling methods can be developed and suitable analysis techniques selected, thus forming the basis of routine inspections.

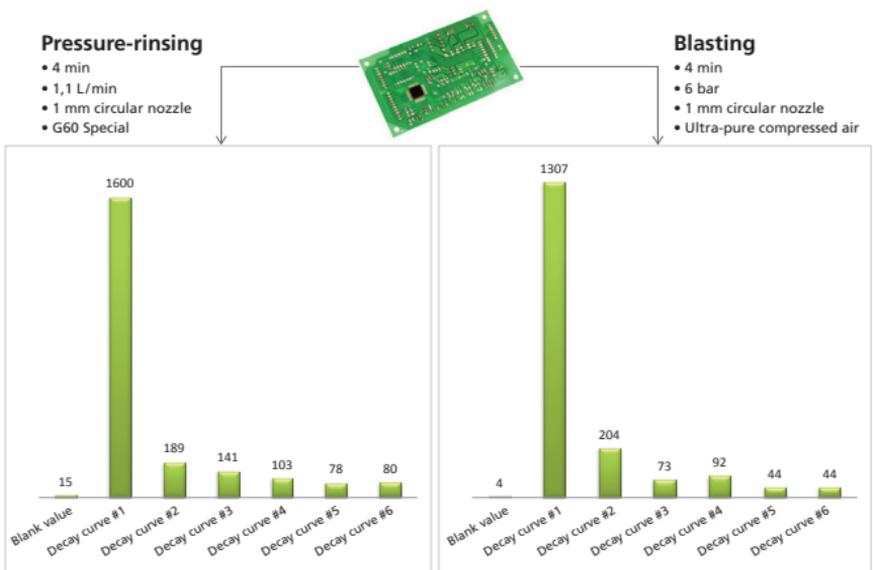


Example of results from a test to compare blasting (without a liquid, only ultra-pure compressed air) and pressure-rinsing (with a liquid).



Air extraction

For many components, such as electronic products, a cleanliness inspection using a liquid is a destructive testing method. Therefore, in order to inspect combined optical, electronic and precision engineering systems, packaging materials and vehicle headlights, an alternative technique using ultra-pure compressed air has been developed to detach particulate contamination. The suitability of this new so-called air extraction method has been proven in a highly impressive way.

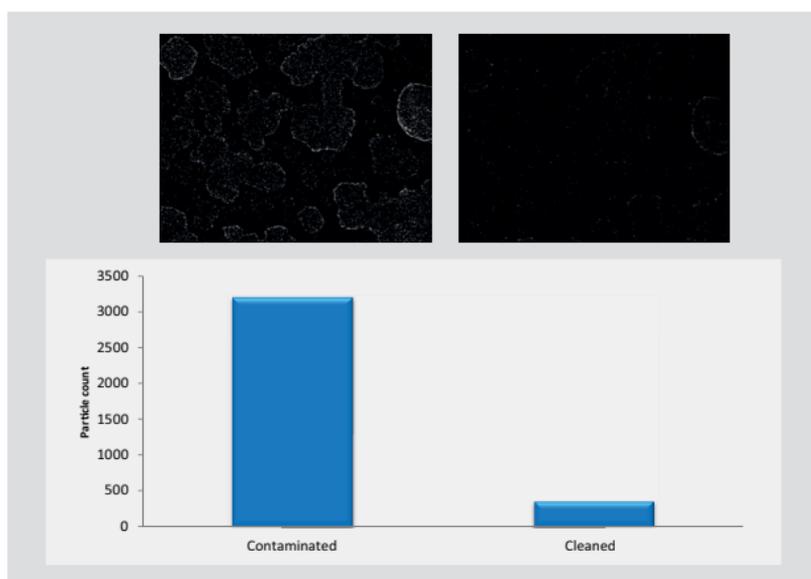


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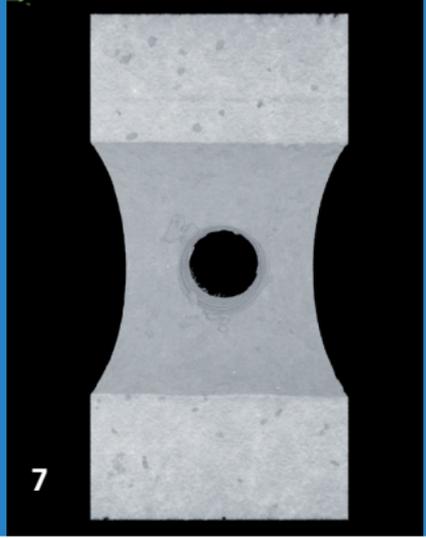
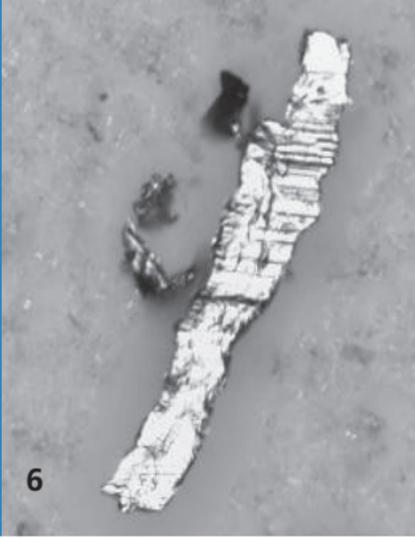
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Assessing the efficacy of cleaning processes

Thanks to the analysis possibilities available in the CleanLab, the efficacy of cleaning processes can be evaluated in various ways. Cleaning efficacy is determined by first applying test contamination to a substrate and then assessing its state of cleanliness before and after cleaning. In order to transfer the ascertained degree of cleaning efficacy to other forms of contamination, for example the adhesive properties of particles can be determined. This enables conclusions to be drawn about the ability to remove other types of contamination using the same process.



Microscopic analysis to assess the efficacy of a wiping technique using fluorescing test contamination.



Infrastructure available (extract)

Testing environment

- Turbulent cleanroom areas with Air Cleanliness Class 6 and 8 according to ISO 14644-1
- Localized laminar cleanroom areas

Extraction facilities

- Pressure-rinsing cabinet for different-sized components
- Equipment for extraction via ultrasound
- Rinsing system with high volume flows
- Separate testing area for highly-clean components

Analysis facilities

- Light microscope for automated particle analysis
- Fluorescence microscope
- Scanning electron microscope for automated particle analysis
- Micro-CT for 3D particle analysis
- Scanner for particle analysis
- Five-digit analysis scales

TITLE *CleanLab analysis area.*

5 *Automated CO₂ snow jet cleaning.*

6 *Microscopic image of a damaging particle.*

7 *CT image of a burr inside a component.*

8 *Automated microscopic or correlative particle analysis.*



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