



# Fraunhofer

IPA

FRAUNHOFER INSTITUTE FOR  
MANUFACTURING ENGINEERING AND AUTOMATION IPA

## RANGE OF SERVICES QUALIFICATION (EXTRACT)





## Measurements performed, testing equipment

### *Particle detection*

- Airborne
  - Optical particle counter (OPC): 0.1 to 25  $\mu\text{m}$
  - Condensation nuclear counter:  $\geq 5 \text{ nm}$
  - Compressed gases: max. 10 bars: OPC 0.1 to 25  $\mu\text{m}$
- Directly on surfaces
  - Wafer inspection devices: 67 nm to 63  $\mu\text{m}$
  - Surface contamination counter (SCC): 0.5 to 100  $\mu\text{m}$
  - Light microscope:  $\geq 1 \mu\text{m}$
  - Scanning electron microscope:  $\geq 5 \text{ nm}$
  - Laser scanning microscope, 3-D imaging of contamination
- Indirectly on surfaces
- On frictional pairs
  - Atmospheric: material pairings (in dependence on normal force and speed of travel):  $\geq 0.1 \mu\text{m}$
  - In a vacuum:  $\geq 67 \text{ nm}$

### *Particle analysis*

- Energy dispersive x-ray analysis (EDX)
- Analysis of organic particles using Raman spectrometer

- 1 Using an optical particle counter in the Fraunhofer IPA cleanroom.
- 2 Laboratory for analyzing particulate contamination.

### ***Outgassing (ACC)***

- Technical information on substances detected
- Thermodesorption GC/MS
- Chamber measurements
- Room measurements
- Headspace GC/MS
- Thermal extraction

### ***Biocontamination***

- Agar contact method
- Airborne CFUs
- Waterborne CFUs
- Total microbial count via microscopic counting
- Ability to resist metabolism

### ***Airflow***

- Airflow velocity, direction and visualization (DI/N2-fogger, smoke wire, test tubes),
- Qualitative/quantitative analysis
- Flow rates (volume flow)
- Recovery time
- Pressure difference

### ***Climate***

- Temperature
- Humidity



2

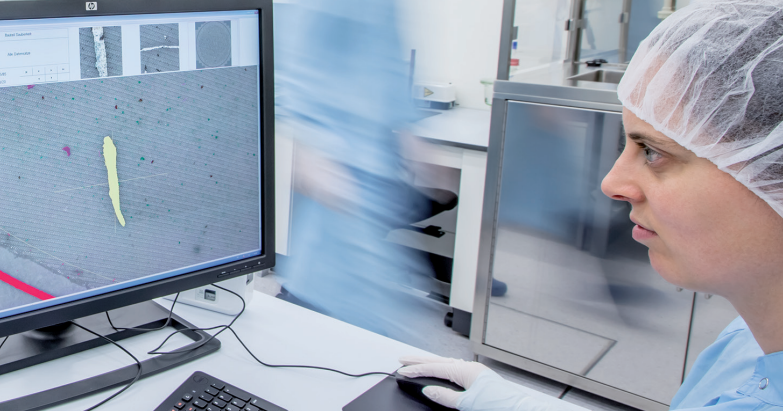
- Surface quality
- Roughness
- Surface finish, EDX, AFM/STM, ESCA (XPS), AES, FTIR, TEM

### *ESD*

- Discharge resistance
- Volume resistance
- Surface resistance
- E-field determination
- Discharge time
- Conductivity

### **Testing environment: cleanrooms and laboratories**

	Laminar cleanrooms	Turbulent cleanrooms
Air cleanliness class (as per ISO 14644-1)	ISO Class 1	ISO Class 2
Airflow velocity	0.45 m/s	0.45 m/s
Airflow type	Vertical, laminar	Turbulent
Temperature	22 °C ± 0,5 °C	22 °C
Relative humidity	45 % ± 5 %	45 %
Surface area	125 m <sup>2</sup>	80 m <sup>2</sup>
Other	–	–



### *Oscillation & Acoustics*

- Vibration
- Sound measurements

### **Media supply for the laboratories**

- Ultra-pure water (DI water in VLSI quality)
- Ultra-pure compressed air
- Vacuum
- UPS systems, 220/380 Volt power supply
- Nitrogen 5.0
- **Liquid CO<sub>2</sub> supply 6.0**

Turbulent cleanrooms	Media laboratory	Heavy duty cleanroom
Class 6	ISO Class 8	ISO Class 1
0.5 m/s	–	0.45 m/s
Turbulent	Turbulent	Vertical, laminar
22°C ± 0,5°C	22°C	22°C ± 0.5°C
45% ± 5%	45% ± 5%	45% ± 5%
50m <sup>2</sup>	50m <sup>2</sup>	120m <sup>2</sup>
–	–	Load: 5 t/m <sup>2</sup> , ceiling height: 6 m

## Our services

Qualifying of operating utilities and materials for their cleanroom suitability and cleanliness suitability

- Particle emission behavior
- PWP measurements
- Outgassing behavior
- Particle analysis
- Material analysis
- Ease of cleaning and disinfection
- Resistance to chemicals
- Ability to resist microbial metabolism
- ESD characteristics
- Surface quality
- Airflow patterns
- Leakproof tests
- Microbicidity
- Product compatibility
- GMP/EHEDG design analysis

**TITLE** *Classification tests on lighting systems.*



**Fraunhofer**

**TESTED<sup>®</sup>  
DEVICE**

Flex Prod Robots GmbH  
System Flexi Pro 392 ALX  
**Report No. FL 0903-974**

## Advantages of qualifications

- Internationally-recognized test label
- Independent institute
- Only testing infrastructure of its kind in the world with Class 1 cleanrooms according to ISO 14644-1
- Experts on cleanrooms and clean manufacturing engineering
- Holistic approach
- Standardized procedure:
  - Test preparation
  - Test bench
  - Auxiliary aids
  - Parameters and general conditions
  - Objective and representative selection of test samples from the total range available
  - Documented test procedures and results
  - Tests carried out in compliance with internationally recognized norms and standards
- Statistical analysis of test results
- Representative results
- Customer/market-orientated documents included
  - Certificate
  - Qualification document
  - Test report
  - Test logo

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If you require more information about our range of services or specific advice, please get in touch with our contact partners.

**Department**

Ultraclean Technology and Micromanufacturing

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