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IPA

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

2ndSCIN®

Enabler for cleanliness-critical Automation Technology

2ndSCIN® for crane system with hoist.

Status quo

Current surveys show that companies manufacturing under clean conditions are becoming increasingly dependent on cleanliness-compatible automation components. Particles or chemical and biological residues, which are released from machinery into the manufacturing environment and affect product quality and reliability, pose a major challenge. To compromise for this, fixed enclosures or minienvironments are often used to contain contaminants.

Our solution

Since previous containment systems do not meet industry's high cleanliness requirements, experts from Fraunhofer IPA have faced this challenge and come up with a solution.

2ndSCIN® is a specially designed textile protective cover that can be used to make hardware components such as robots, grippers, and manufacturing systems suitable for use in clean production environments. Using the CAD data from dynamic automation components, individual "tailor-made machine

suits" are quick to produce. Thanks to the customized fit, the freedom of movement of the systems is hardly affected. Inspired by human skin, 2ndSCIN® is a supple, air-permeable, multi-layer fabric that isolates the machine from the manufacturing environment. The different textile layers are separated from each other by spacers and are capable of transporting and discharging gases, moisture, substances, and particles by means of airflow technology. The volume flow is adapted to the size and individual requirements of the robot concerned. If required, the cleanliness-compatible skin can be equipped with sensor networks that continuously collect data relating to particulate contamination, chemical impurities, moisture, etc. These data can then be evaluated with the help of AI algorithms. As a result, cleanliness conditions both inside and outside the 2ndSCIN® system can be monitored and an appropriate predictive maintenance strategy derived.

Potential fields of application

The encapsulation system was originally developed for use in the semiconductor industry to ensure that standard robots do not emit particulate contaminants. Thanks to the 2ndSCIN® envelope, robots can now even be used in cleanrooms fulfilling ISO Class 1 specifications. The use of special textile and material combinations also reduces outgassing behavior to the extent that chemical emissions are only just detectable by TD/GC-MS.

2ndSCIN® system for six-axis robots, almost no movement restriction.

During the SARS-CoV 2 pandemic, it became clear that there were not enough highly efficient, sterile automation systems of the kind needed to manufacture vaccines worldwide. With 2ndSCIN®, existing robots can now be upgraded to produce sterile vaccines within the space of just a few hours.

The GMP-compliant design and optional integrated gassing options (H_2O_2, N_2, etc.) also mean that the system can be used for other sterile manufacturing applications, such as in the life science, medical and biotechnology industries.

Our services

Development of a tailor-made 2ndSCIN®
- Design
- Realization
- Installation
- Approval

Product-specific data

- Zero particles and outgassing:
  – suitable for ISO Class 1 to 9 according to ISO 14644-1
  – suitable for ISO Class 9 according to ISO 14644-8
- Application in various sectors: Pharmaceutics, food industry, medical industry, semiconductor industry, electronics, optics etc.
- For life science applications: GMP-compliant design enables robot and protective cover to be sterilized
- Freedom of movement remains almost unaffected
- Suitable for a wide range of automation components

Cover:
- Customizable – "cleanliness-suitable tailor-made suit"
- Structure: textile multi-layer structure, adjustable airflow direction and pressure differential
- Use of cleanroom compatible materials
- Highly resistant to abrasion
- Low chemical emission spectrum
- Dissipates electrostatic build-up
- Sterilizable, washable
- Can be used for rotary and articulated arm movements
- Short set-up time: a few hours

Airflow technology:
- Highly adaptable ventilation units to create positive/negative pressure conditions
- Highly efficient filtration (particulate, chemical, biological)
- Multi-layer structure flooded with N_2, ultra-pure compressed air, etc.
- Robots disinfected/sterilized by gassing with H_2O_2

Artificial intelligence:
- Structure: fitted with sensors for continuous data acquisition
- Contamination sensors: particles, chemical impurities, ESD properties, biocontamination
- Operating parameter sensors: temperature, humidity, gas, airflow, air pressure
- Condition monitoring: actual status continuously displayed: integrity, cleanliness features, room conditions
- AI-based data analysis: forecasting tool, predictive maintenance for assessing
  – particulate emissions over time → contamination risk, wear
  – chemical emissions over time → contamination risk, aging

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