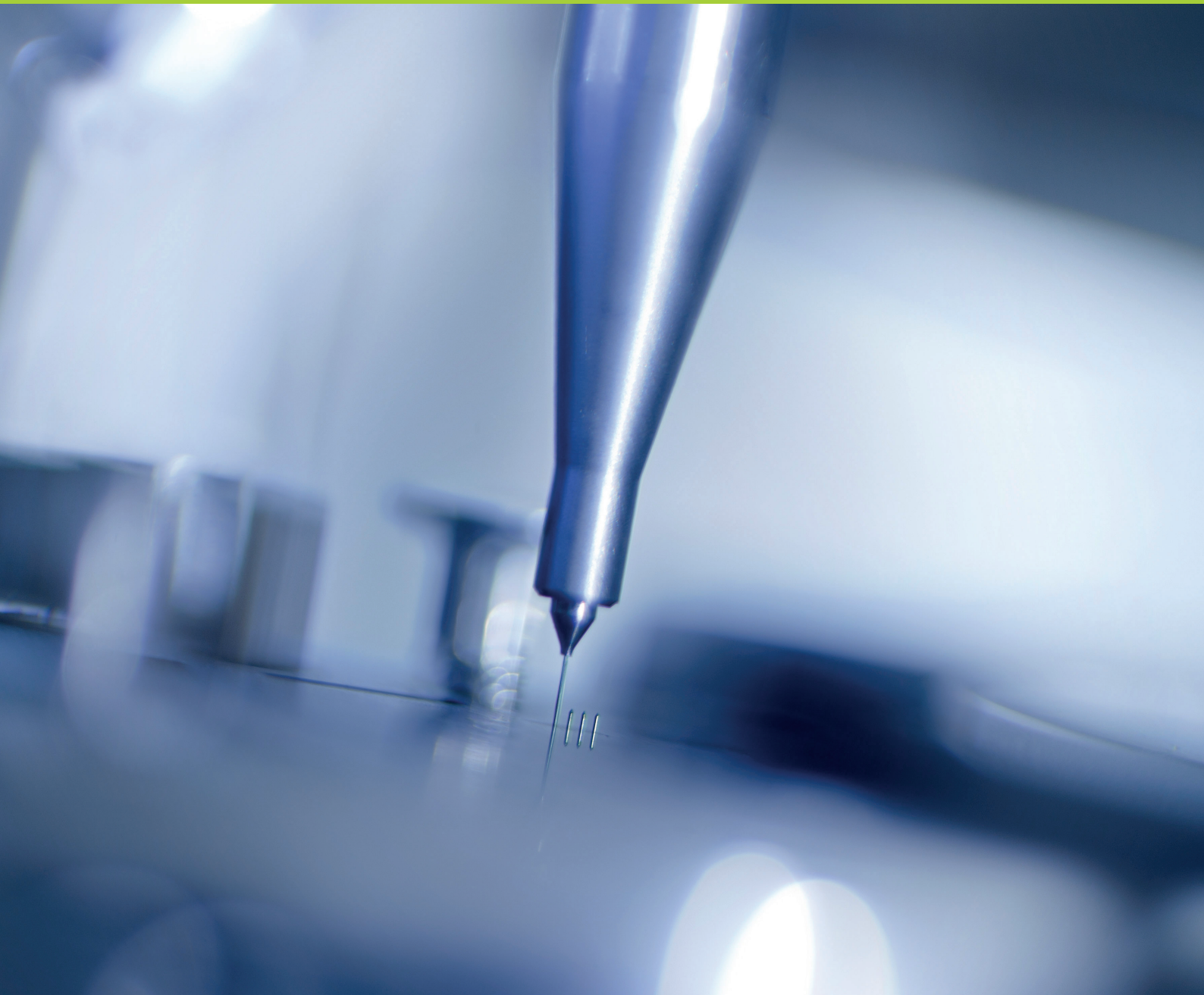


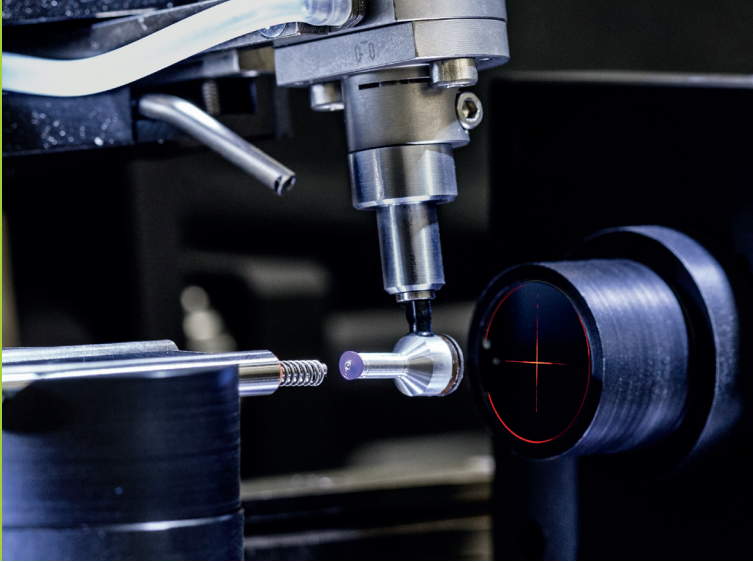
MICROASSEMBLY

MORE THAN JUST PRECISION



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WHO WE ARE

Small but smart. We can provide you with the solution you need.

Driven by the constant pressure to innovate, companies constantly develop new products. In the process, they integrate more and more components from the areas of electronics, microtechnology, mechatronics, sensor technology and nanotechnology. New products often require adapted manufacturing methods or even the development of completely new ones. For such companies, we are an ideal research partner when it comes to pursuing new manufacturing paths. Since we were founded in 1984, we have become one of the world's most important research and development service providers in the field of ultraclean technology and micromanufacturing.

Experienced in treading new ground

Only someone who really understands their customers and their requirements is able to develop the solutions they are looking for. We support our customers during the conception phase, through project realization, right up to the moment when they put machines or even complete factories into operation. We implement ground-breaking research results and transfer our expertise to the companies we work with. Our customers include leading global concerns as well as medium-sized firms in Germany and other European countries.

Cutting-edge infrastructure for high-end results

Our cleanliness laboratories and cleanroom labs are equipped with state-of-the-art technology and provide ideal conditions for developing highly-accurate contamination-sensitive processes. We also operate the cleanest cleanroom in the world, which is 10 times cleaner than the air cleanliness class ISO Class 1. With a surface area of over 150 m², such conditions enable us to carry out even heavy-duty contamination control tests.

Independence inspires confidence

One of the main reasons why companies place their trust in us is because we are independent. You don't always need the highest degree of precision or the most expensive cleanliness class – and we let you know that. As an institute of the Fraunhofer-Gesellschaft, it's our job to carry out applied research that will benefit companies directly and be of advantage to the society. Thanks to this attitude, our power of innovation, our willingness to take risks and our wide range of working fields, we enjoy a high level of recognition and acceptance within the industry. In many cases, we also act as a mouthpiece of the economy, for example because of our involvement in the development of internationally-valid standards and guidelines.

SMALL CHALLENGES

Innovative solution approaches to enable smaller and smaller products with high integration levels to be manufactured are a challenge both to man and machine. Especially component handling and, where applicable, pre-handling, is associated with major requirements because assembly components are not only smaller but also more delicate.

Handling micro components

In the world of assembly, singularization, magazining, transportation, storage and provision are all elementary processes. In microsystem technology, they have a major influence on the degree of product quality that can be achieved. For example, with each handling step, the risk increases that a component might become damaged or that its functional structures that affect quality may become contaminated. Known solutions for macro-sized components have reached their technical limits and are only able to fulfill growing requirements to a certain extent.

With IPA.FluidSorting, which is modeled on an example found in nature, Fraunhofer IPA is pursuing a new method for singularizing, gripping and feeding very small components. Using the phenomenon of the water beetle, our experts make use of existing surface forces to sort and organize pourable goods.

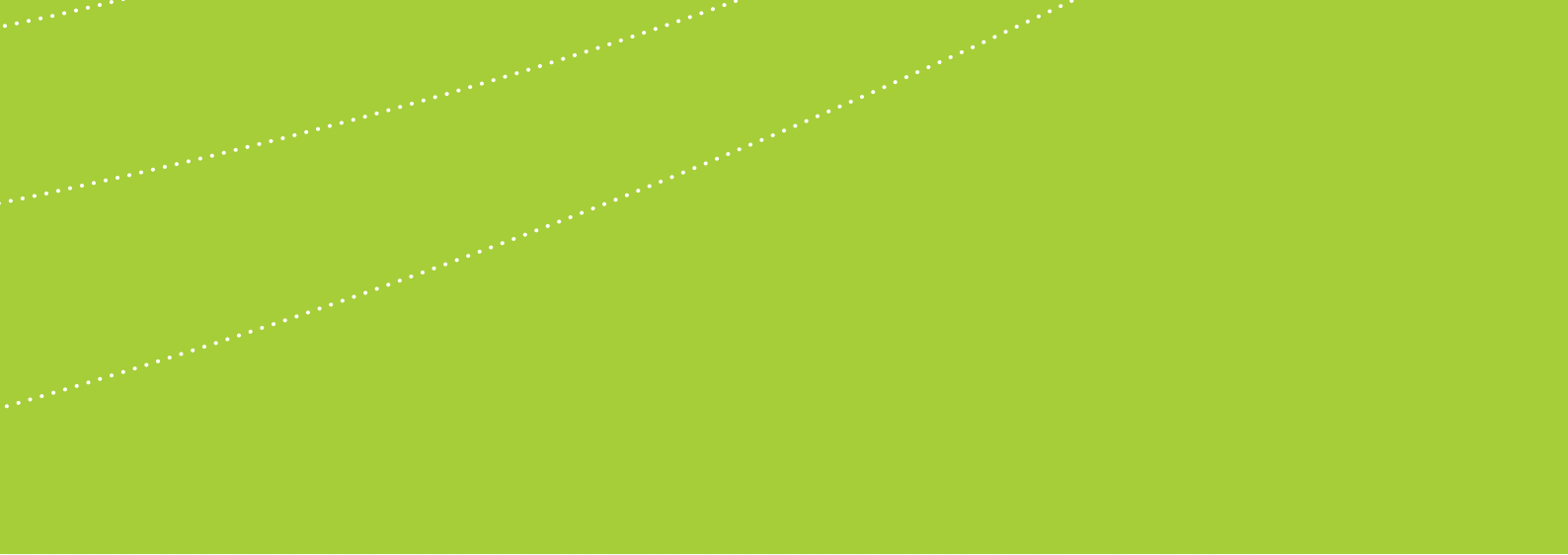
Another focus of developments is on workpiece carriers and magazining. Our objective is to reduce the number of handling and stocking steps in assembly to a minimum. To achieve this, we design component-receiving areas to maximize overall process capability, e. g. to enable optimum access for cleaning and subsequently inspecting relevant surfaces.

Where workpieces or process environments need to be monitored, or where a process needs to be actively assisted, we integrate sensors and, if necessary, actuators into carrier systems. Systems are constructed with high modularization levels to make them flexible for use with a wide range of components and applications.

Cleaning, modifying and inspecting components and surfaces

Small delicate objects are associated with a number of challenges. Many process steps affect product quality, such as cleaning substrates and components and, where required, adjusting or modifying object surfaces in a defined way and assessing their condition. Our main focus is on gentle component handling and on confining processes, for example, to contact areas on functional surfaces.

Fraunhofer IPA controls and develops a broad spectrum of localized cleaning technologies for removing particulate and filmy contamination from defined areas. As a basis for its customized solutions, it also offers high-resolution measuring and testing techniques for 2D and 3D surface inspection. With cleanrooms at its disposal with air cleanliness classes even as pure as ISO Class 1, it also has the clean laboratories it needs as reference environments to carry out the respective processes.



PRECISE STRUCTURES

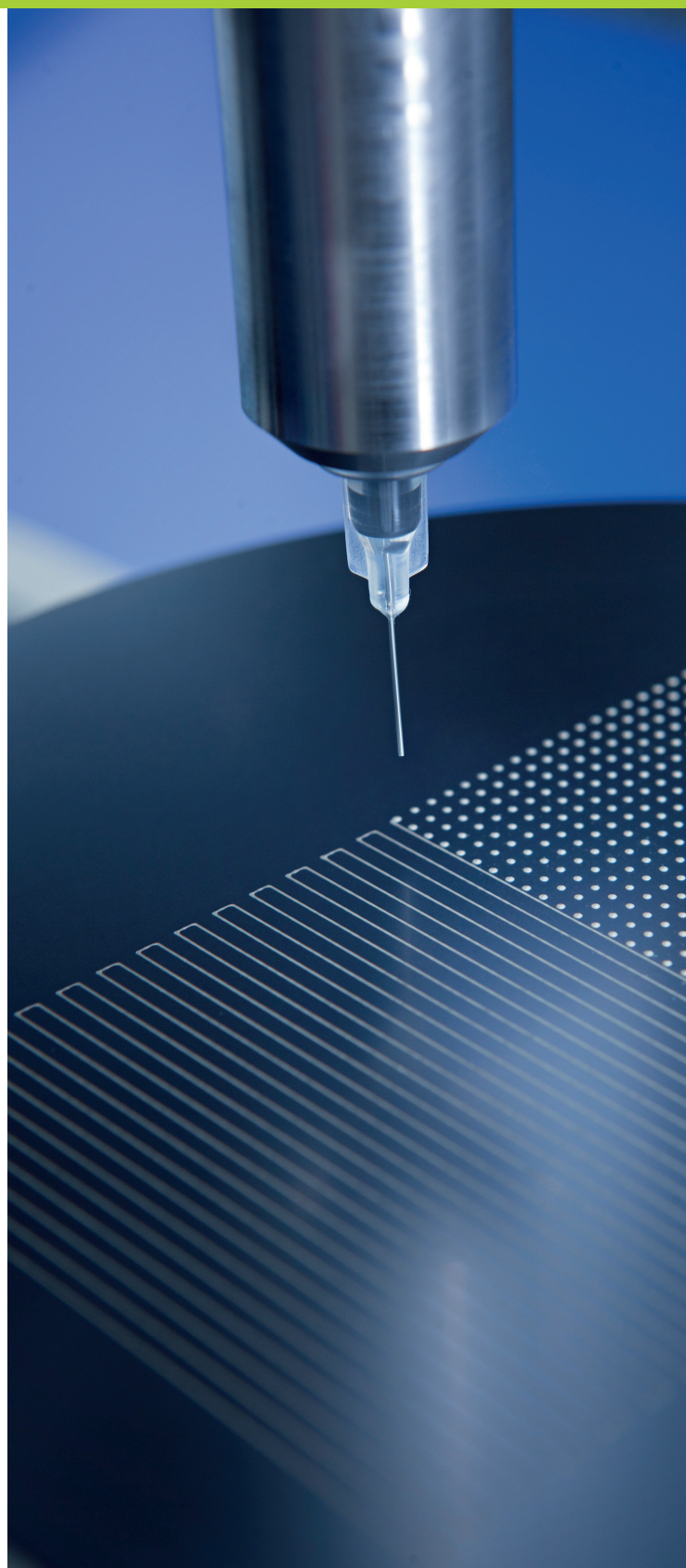
In manufacturing and also in day-to-day life, there is a demand for reliable methods for dispensing viscous media; in some cases, this is even mandatory in order to manufacture high-quality products. Fraunhofer IPA has developed a technique for applying minute quantities as small as a picoliter, thus enabling highly-accurate structures to be created.

Dots, lines and areas

Whether applying dots of adhesive to fix components, or lines along component edges for encapsulation purposes, or larger areas to coat component surfaces – not only are accuracy requirements rising as far as volumes, application sites and sometimes even cross-section profiles are concerned but structure widths are also becoming increasingly smaller at the same time. To fulfill such demands, dispensing systems have to be extremely reliable and capable of high-precision media application. We focus on both these aspects in our developments.

In order to be able to create a specific application pattern, we first assess customer systems to see if we can integrate sensors and actuators to improve performance and quality. If this approach cannot be pursued, we then offer to develop a completely new system.

In our search for solutions we take a holistic approach: we do not just consider core processes but also the influences of component quality and the immediate environment. In consequence, the overall result may identify a need to add or modify pre-process cleaning steps or post-process inspection steps, or even introduce measures to maintain specific conditions.



ACCURATELY POSITIONED – EVEN IN 3D

People want products to be compact and highly functional at the same time. For manufacturers and equipment suppliers, this means having to find assembly and integration solutions that, in extreme cases, enable high-accuracy positioning, almost forceless joining and, in the future, three-dimensional component placement. We'll help you to conquer these and other challenges.

Positioning, adjusting and joining microcomponents accurately

With component sizes smaller than one millimeter and a required accuracy of just a few micrometers, conventional positioning and joining technologies are increasingly reaching the limits of their capabilities. To make things more complicated, today's components have less mechanical stability and are more sensitive to contamination, with the consequence that supplementary protective measures are required.

On top of further developing established joining techniques by integrating a combination of various pathless and force-resolving actuator elements into systems, we are also pursuing new, unconventional methods. One example of this is our fluid-based solution approaches that make use of surface forces to sort and orientate components on substrate surfaces.

Hybrid manufacture of multifunctional high-integration products

By combining layer construction methods with microassembly and integration technologies, new potentials are opening up for individual products. For example, lighting systems for illuminating a component in an optimum way can be individually adjusted during processing. User-specific fluidic systems for preparing and analyzing liquid samples are a further possibility.

Working together with the highly-competent additive manufacturing department, we are in a position to evaluate product feasibility during the development phase, design products for ease of manufacture and implement them as prototypes. With a focus on industrial manufacturing, we develop tailor-made process and system solutions for manufacturing innovative products with the aid of hybrid engineering methods.



HIGHLY COMPACT AND ADAPTABLE

Microtechnology products are generally available in a high number of variations and in low to medium-sized piece numbers. Some of them even require a defined clean environment for their manufacture. Consequently, in order to assemble them cost-effectively, production systems have to be scalable, adaptable and compactly built. We develop appropriate solutions with high modularization and miniaturization levels.

Modular tool and plant technologies

When we develop manufacturing and assembly technologies, we strive to realize system solutions that can be rapidly and easily adapted using equipment modules and tool modules from a kit. Regardless of whether it is a tool, a piece of equipment or a complete machine. We develop both universal and customized modularization concepts for mechanical and control solutions.

We also realize the corresponding mechanical and information interfaces as well as the necessary module technology – in particular for microassembly processes. Through our work in standards committees, we not only contribute towards the development and fixing of standards but are also kept up to date about their progress.

In addition to this, we support the definition of individual requirements. Methodical procedures combined with analysis and characterization aids guarantee that comprehensive needs profiles are compiled.

Miniaturized system solutions

Laboratory areas and manufacturing areas – especially in clean-rooms – are associated with major costs. That is why we take care during developments to minimize footprints, for example in the case of our μ -ProductionTower.

Furthermore, with today's machine technology, in order to economize on resources we also try to adapt often oversized workspaces to the size of the product being processed. This is done by using microcomponents and minienvironments to realize compact machine sizes.

US FOR YOU

Immaculate industrial consulting

We are also happy to pass on our experience in cleanroom technology to others. Therefore, we advise our customers from the conception phase through realization right up to putting machines and even complete production facilities into operation. Our research and development services cover topics such as production planning, manufacturing optimization, cleanliness technology, cleaning technology, metrology, microassembly, plant development and logistics.

Cutting-edge infrastructure for high-end results

To ensure optimum results, we use the latest equipment in our laboratories. These include positioning and assembly systems with accuracy levels below five micrometers, precision dispensing systems, and machines for selective surface cleaning and surface modification that use CO₂ and atmospheric plasma. To perform analyses, among other devices we use microscopes, contact angle measuring systems and shearing and tensile test equipment.

Realistic research

Our application-orientated approach allows us to collaborate with industry in way that is unique. We identify ourselves with our customers' aims because we are motivated by their success. As a result, together with research and industrial partners, we develop and optimize manufacturing equipment and work environments. We're also involved in setting up platforms that bring together decision-makers and opinion leaders from research and industry.

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References and contact partners

To find out more about us, please
visit our website.

