

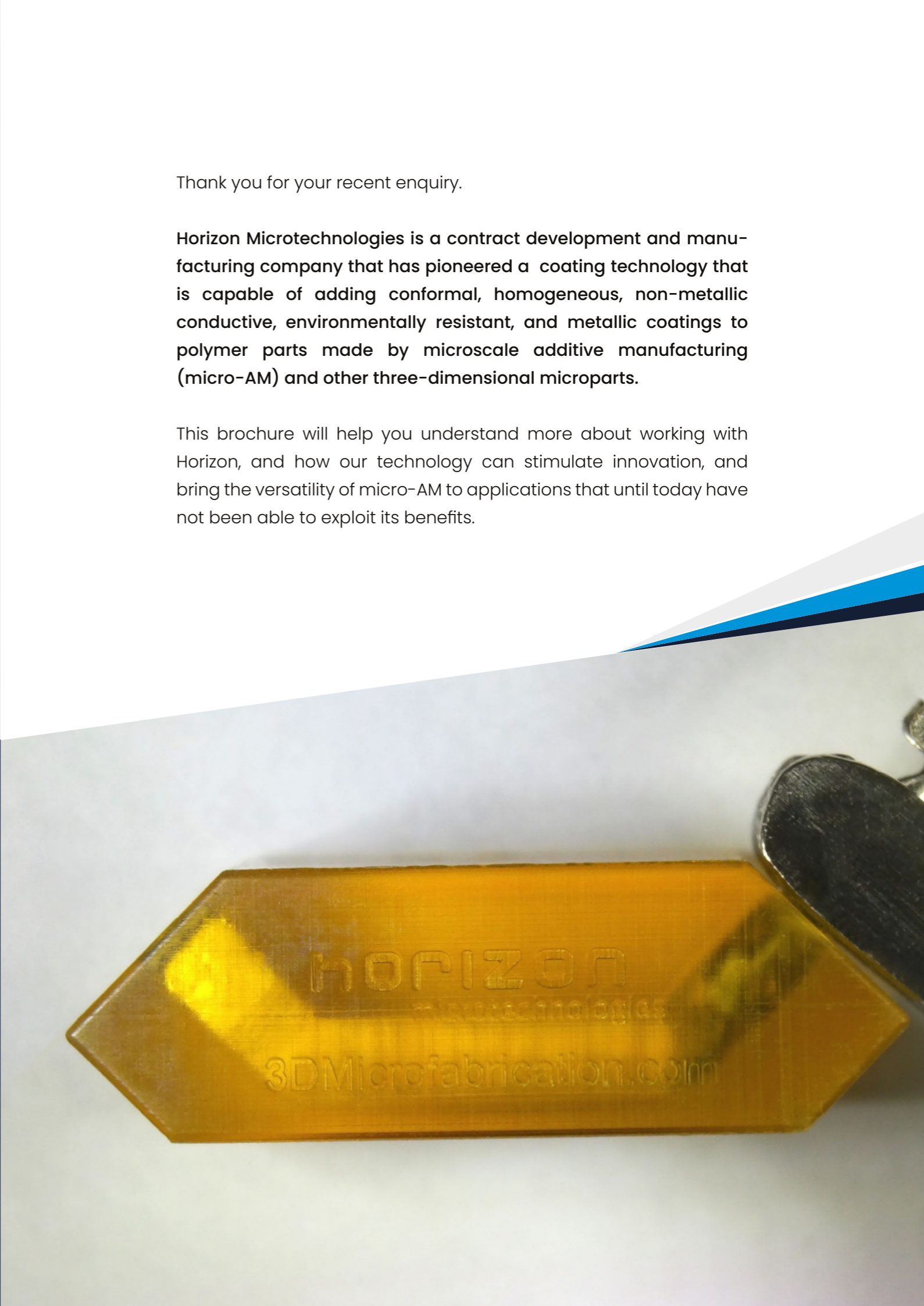
hORIZON
microtechnologies



Thank you for your recent enquiry.

Horizon Microtechnologies is a contract development and manufacturing company that has pioneered a coating technology that is capable of adding conformal, homogeneous, non-metallic conductive, environmentally resistant, and metallic coatings to polymer parts made by microscale additive manufacturing (micro-AM) and other three-dimensional microparts.

This brochure will help you understand more about working with Horizon, and how our technology can stimulate innovation, and bring the versatility of micro-AM to applications that until today have not been able to exploit its benefits.



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ABOUT HORIZON


Horizon Microtechnologies is expert in 3D microfabrication, so if you are interested in analyzing the appropriateness of our proprietary in-house coating technologies, you are also able to benefit from our innate understanding of manufacturing at the micro level.

Where appropriate, you can simply use us as a service or technology provider. However, when the project demands, we can also work with you as an integrated product development partner. Optimal production outcomes depend upon optimised part design. As your product development partner we can help in design for manufacturing (DfM) issues, as well as providing demonstrator / prototype parts, and ultimately ramping up to production.

Every member of the Horizon Microtechnologies team is characterised by integrity and dedication. Integrity demands that we focus purely on customer satisfaction, and central to every project we undertake is a focus on an honest, straight-forward, collaborative working relationship. In this way we optimise outcomes and add real value to your business. Dedication means that we are always fully accountable and defined by your success. We are purely focused on the achievement of optimal results to your timeline and performance requirements, and pre-emptively address situations as they arise.

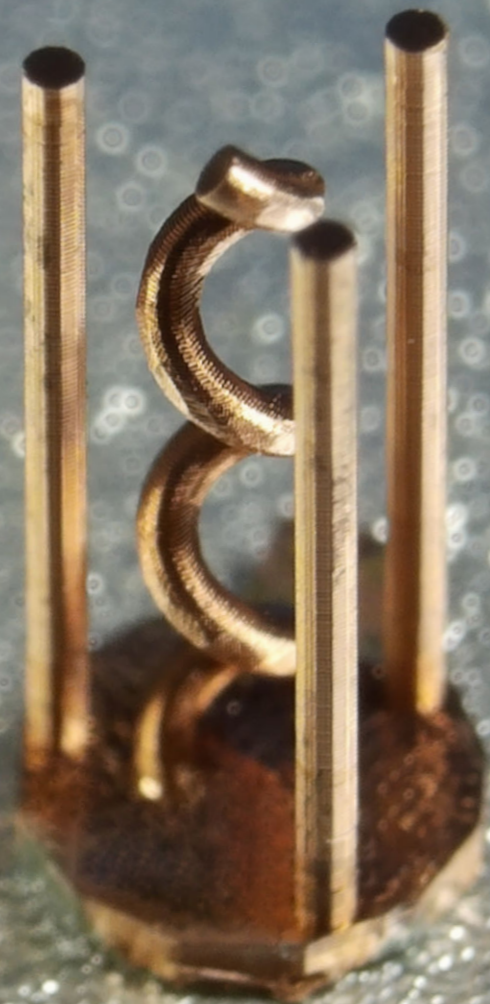
We succeed if you succeed in your product development goals, and as your partner, we will work with you to ensure a healthy and creative relationship built around the realisation of innovative and next generation products.

Contact us for more information

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MICROSCALE ADDITIVE MANUFACTURING – OVERCOMING MATERIAL LIMITATIONS



1 mm

There is no doubt that micro-AM has disrupted the ways in which various sectors produce end-use parts for an array of applications. The dawn of ultra-precise micro-AM technologies recently opened up the advantages of AM for micro manufacturers, and by developing our in-house post process coating technology we have extended the areas in which AM can have a positive influence.

Using micro-AM can in many instances be cheaper and quicker than using conventional manufacturing processes, stimulates design freedom and allows the production of parts and components with geometric features hitherto impossible.

Through the use of our post process coating technology, you can add transparent conductive layers, environmentally resistant layers, and metallic coatings to micro-AM produced parts. Adding non-metallic conductive and metallic coatings opens up the power of micro-AM for numerous applications such as electrodes and electrical connectors, 3D microfluidic devices, and MEMs and optics packaging. It is also possible to use the conductivity to eliminate the risk of static discharge.

The ability of Horizon's coating technology to add environmental resistance to micro-AM produced parts is important because it enables the creation of microscale devices that are more durable, reliable, and better suited for use in harsh environments such as in the presence of aggressive chemicals and/or high temperatures. This can lead to improved performance and longer lifetimes for these devices, making them more suitable for use in a wide range of applications.

Polymer micro-AM delivers tight mechanical tolerances, easy and repeatable manufacturing processes as well as enabling nearly arbitrary part geometries to be produced. Horizon's proprietary post-printing coating processes introduce the necessary conductivity or environmental resistance required to optimise part performance in applications. By combining a polymer template with functional coatings, Horizon offers a "best of both worlds" approach to 3D microfabrication.

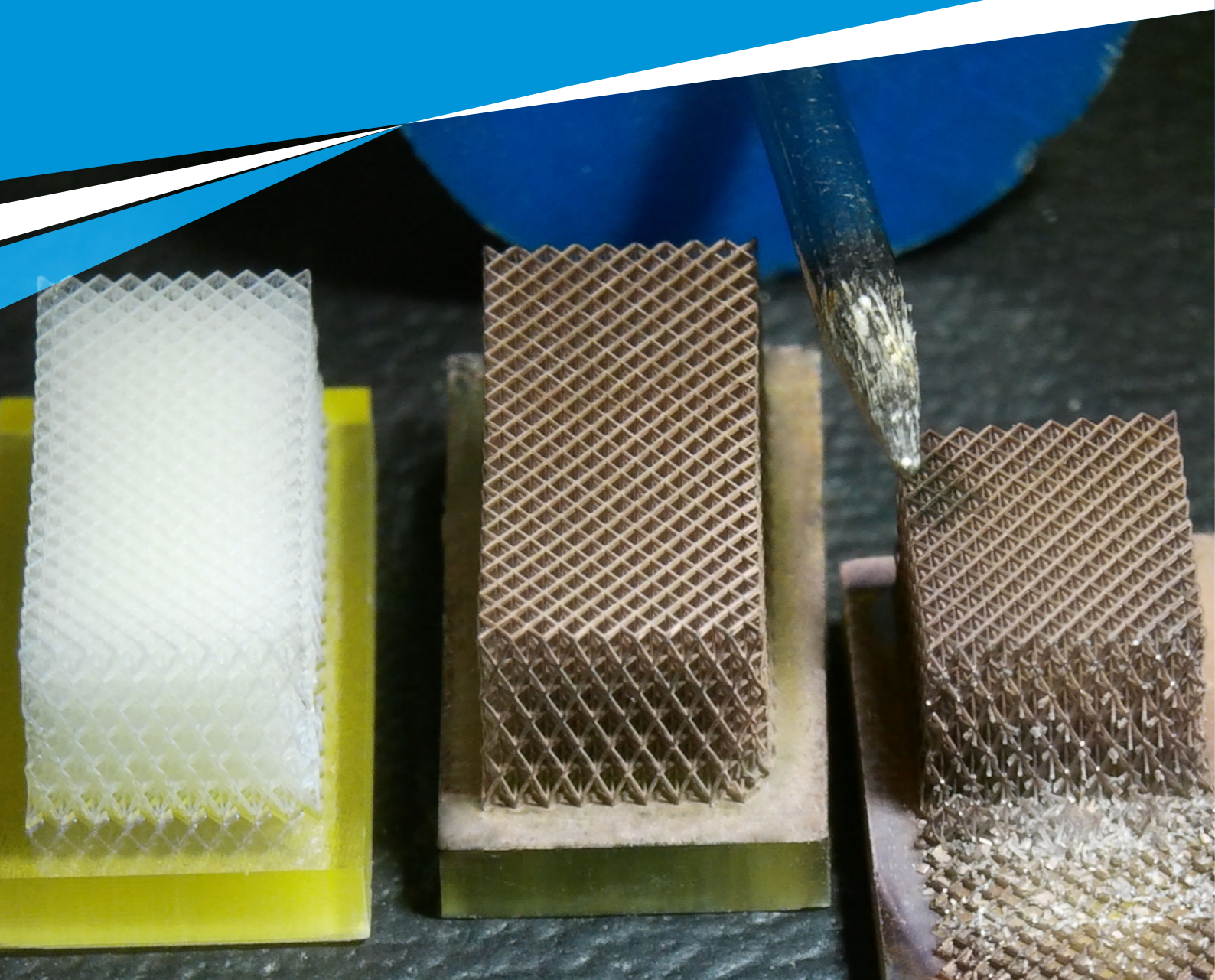
3D COATINGS FOR ADDED FUNCTIONALITY

Horizon has researched and developed its 3D-capable coating technologies over many years. The technology meets the demand from companies wanting to benefit from the advantages and opportunities that exist through the use of micro-AM, but want parts that have functionality impossible due to the limited palette of materials that micro-AM is able to process.

Micro-AM promotes design freedom, the production of parts and components with otherwise impossible shapes, the attainment of tight tolerances, and the ability to freely place internal channels. Our post-build coating technology builds upon these opportunities by adding functionality, specifically non-metallic conductivity, environmental resistance, and metallic coatings.

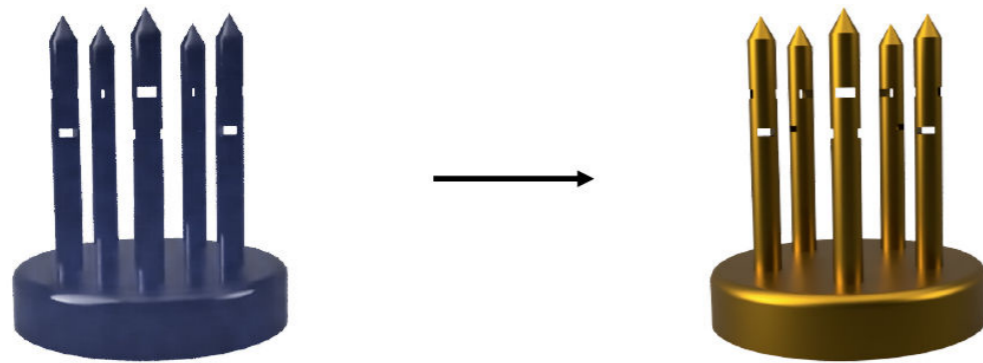
To introduce conductivity, once the part is produced on a polymer-AM platform, it is either wholly or selectively coated with a conductive layer. The layer thickness is controlled very tightly (better than $1\mu\text{m}$) throughout the parts' surface and it can have sheet resistances as low as $20\Omega/\text{square}$. Microfabricated 3D templates can also be coated with metal-oxides to make parts compatible with aggressive chemical environments and in some cases can notably increase the resistance to high temperatures and mechanical stresses. Using these materials, Horizon can even coat difficult areas homogeneously such as long narrow channels with more than 100:1 aspect ratios, bends, branchings and also undercuts. Additionally, the ability to add copper metal coatings to a wide variety of complex-shaped 3D microparts consisting of polymer or ceramics means that for the first time, companies can produce parts with the surface functionalities of copper while also exploiting the bulk material properties, design freedom, precision, and resolution achievable through micro-AM.

Polymeric, metal coated and metal coated and subsequently cut lattice structures. The right-most lattice clearly shows the ability of Horizon's coating processes to reach even deeply recessed sections of parts.

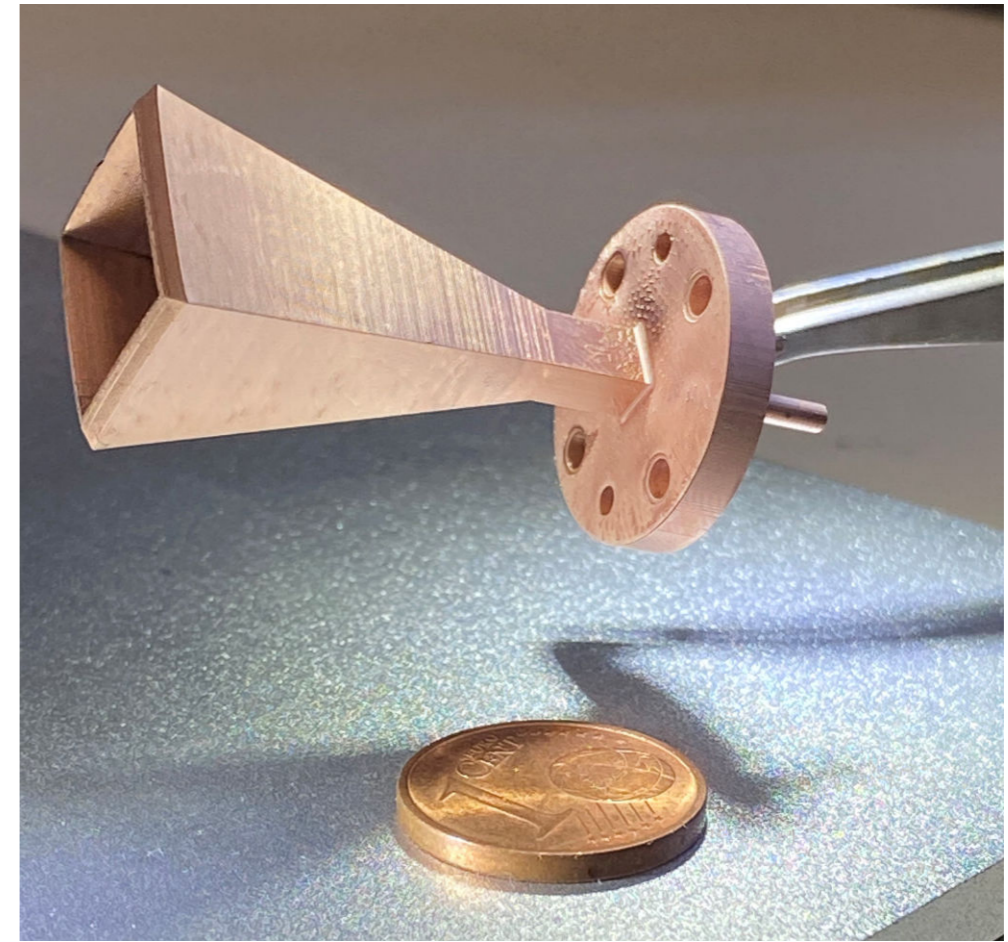


While Horizon's coating processes are mostly agnostic to part geometry and complexity, if selective coating is required, this needs to be accounted for at the design stage of product development. Because of this, Horizon works with customers to optimize outcomes using design for micro-AM and design for microfabrication expertise.

Our in-house post-build technological solutions are an integral and important addition to the AM process chain – stimulating innovation and disrupting the manufacture of micro-scale non-metallic conductive, environmentally resistant, and copper coated parts and components. We are able to add functionality to parts produced from a wide range of micro-AM materials as well as others.



Based on its processes for 3D printing in polymer and subsequent conformal, 3D coating with functional materials, Horizon Microtechnologies offers its customers a "mix-and-match" approach to micropart fabrication: making a template from an optimal material for machining or micro-AM and functionalization of the surface using in-house processes for applying conductive, metallic and mechanically as well as chemically resistant coatings.



Horn antenna for the WR5 frequency range. It was made by polymer micro-3D-printing and subsequently coated with copper.

SUMMARY

- ▶ Horizon Microtechnologies offers contract manufacturing and contract development services for 3D precision and microparts.
- ▶ Coating technology designed explicitly for 3D micro- and precision-machined objects.
- ▶ "Mix and match" approach to microfabrication: Optimal choice of material for machining, especially by micro-AM, with additional functionalities implementable via coatings.

VERTICAL INTEGRATION

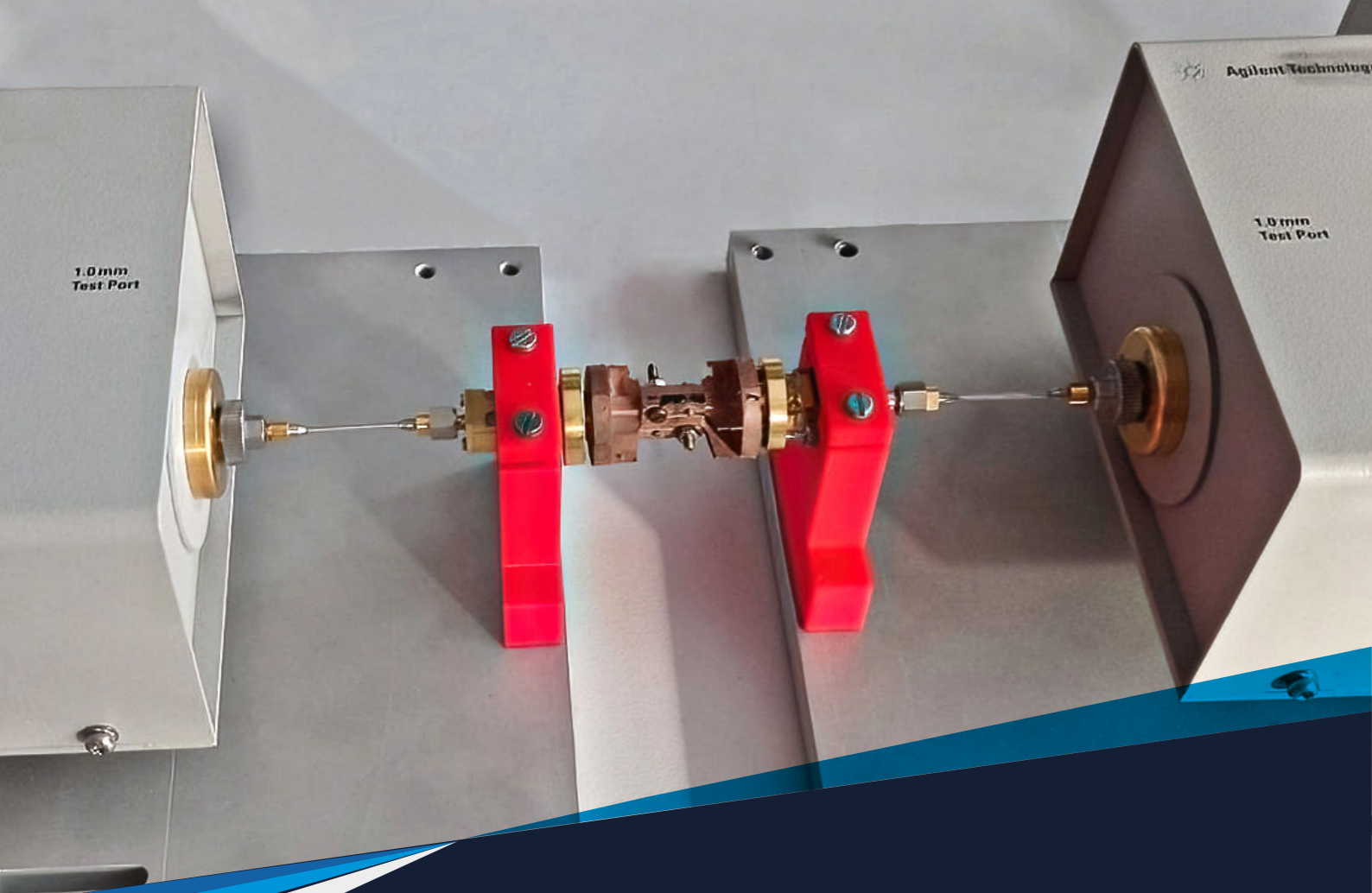


In addition to its suite of in-house coating processes, Horizon Microtechnologies has micro-AM technologies and process metrology located in-house as well. This, combined with the available cleanroom- and yellow-light environment and its unique experience and understanding of 3D microfabrication makes it truly vertically integrated and able to offer customers a one-stop shop from design and development to manufacturing.

Being able to execute the full 3D microfabrication process-chain in-house creates an enormous advantage for our customers who are working with a one-stop shop solution partner. The full technology infrastructure also speeds up R&D and the innovation of our disruptive 3D microfabrication technologies, allowing for a much broader, more agile, and timely interaction with customers.

When producing small, exceptionally precise and tight tolerance parts and components in a multistep process, the significance of a vertically integrated service supplier becomes paramount. Vertical integration entails tight control and coordination over the various stages of production, from raw material sourcing to final inspection. This approach ensures seamless process execution and quality control, optimal material selection, streamlined communication, and enhanced process efficiency.

By eliminating dependencies on external vendors, Horizon can guarantee consistency in specifications, minimize lead times, reduce potential bottlenecks, and ultimately deliver highly accurate and reliable components that adhere to the strictest tolerances and specifications.



APPLICATIONS

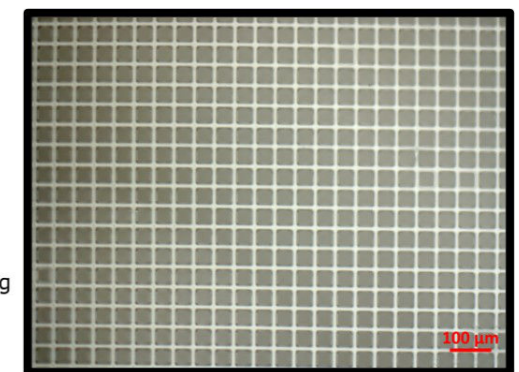
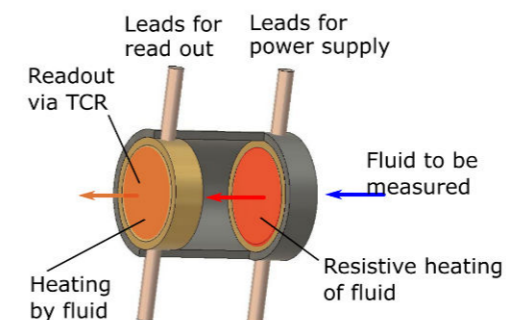
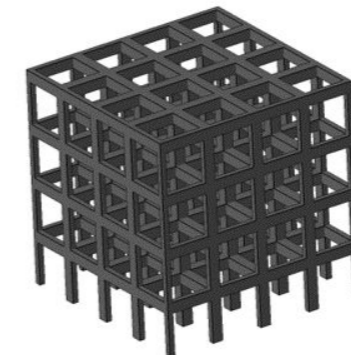
Our 3D microfabrication approach exploits the usefulness of a precisely made polymer micro-AM 3D microstructure or other micropart (the template) for hitherto unserved areas of industry. This is done by adding functionality to the microstructure with a coating process, and thereby overcoming many of the functional limitations of the polymer material from which the micro-AM part is made.

This “best of both worlds” approach is a real game changer for industry and broadens the versatility of micro-AM in an array of applications.

CONDUCTIVITY

Our in-house post-processing coating technology can wholly or selectively coat micro-AM parts with a conductive layer. By so doing, we effectively open up the resolution, tolerances, weight saving possibilities, design freedom, and other attractive features of polymer micro-AM for applications where it is otherwise not appropriate due to the polymer’s material properties.

Our proprietary in-house coating technology is unlike any other on the market, and allows us to offer unique possibilities when adding conductivity to micro-AM parts. We welcome the opportunity to discuss the possibilities this can open up for you.



Conceptualization for a mass flow sensor (bottom left) based on 2 lattice structures (top left) with electrically conductive surfaces made by micro-AM and subsequent coating. Top right: Disk filled with high-surface area lattice structure and close up of the lattice (bottom right).

ELECTRONICS MANUFACTURING

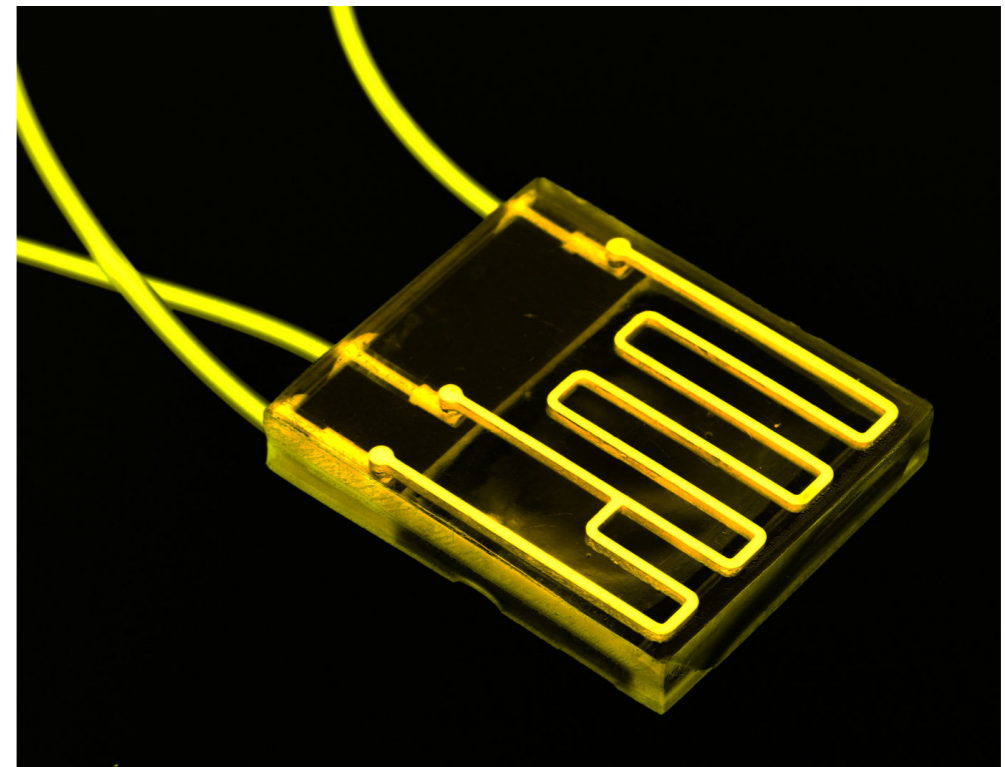
Through the use of Horizon's technology, electronics manufacturing services, developers of assembly and handling equipment, as well as electronics packaging designers can now explore the use of polymer micro-AM without having to worry about ESD compliance. The small features, required tolerances, almost arbitrary shape, and internal channels required by many parts in such applications can be achieved easily using micro-AM, and our coating process introduces the necessary conductivity to prevent ESD issues.



MICROFLUIDICS

Additive manufacturing (AM) is well suited to the production of 3D microfluidic devices. Being able to produce a microfluidic device in one-single step from a CAD model is advantageous, and makes the fabrication of such devices simple, and quick. Today's micro-AM technologies lend themselves very well to prototyping and small batch production of complex, multi-level microfluidic chips, including chips with integrated interfaces or filters.

Using Horizon's post-print coating processes, the surfaces in contact with the liquid can be modified to control surface energy, or introduce electrically conductive elements.

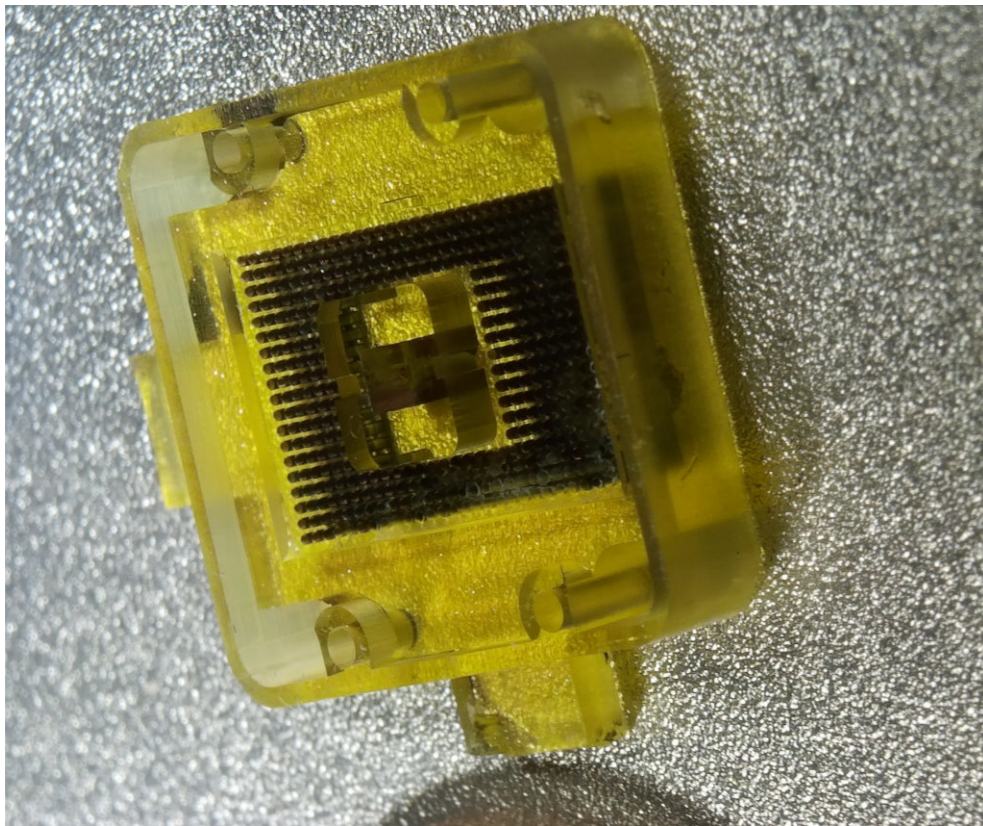


CONNECTORS, ELECTRODES & CONTACT PINS

We can design a device socket, fan-out structure, interposer as well as electrodes and electrical contact pins almost arbitrarily while maintaining manufacturability via micro-AM and our in-house coating technologies.

In comparison to manufacturing routes not based on micro-AM, this allows a broader set of options for requirements such as three-dimensional placement of the active electrode areas and conductive tracks, stiffness (or lack thereof) of the electrodes, and electrical properties of the electrode or electrical contact pin due to the enhanced control over the inductance and capacitance.

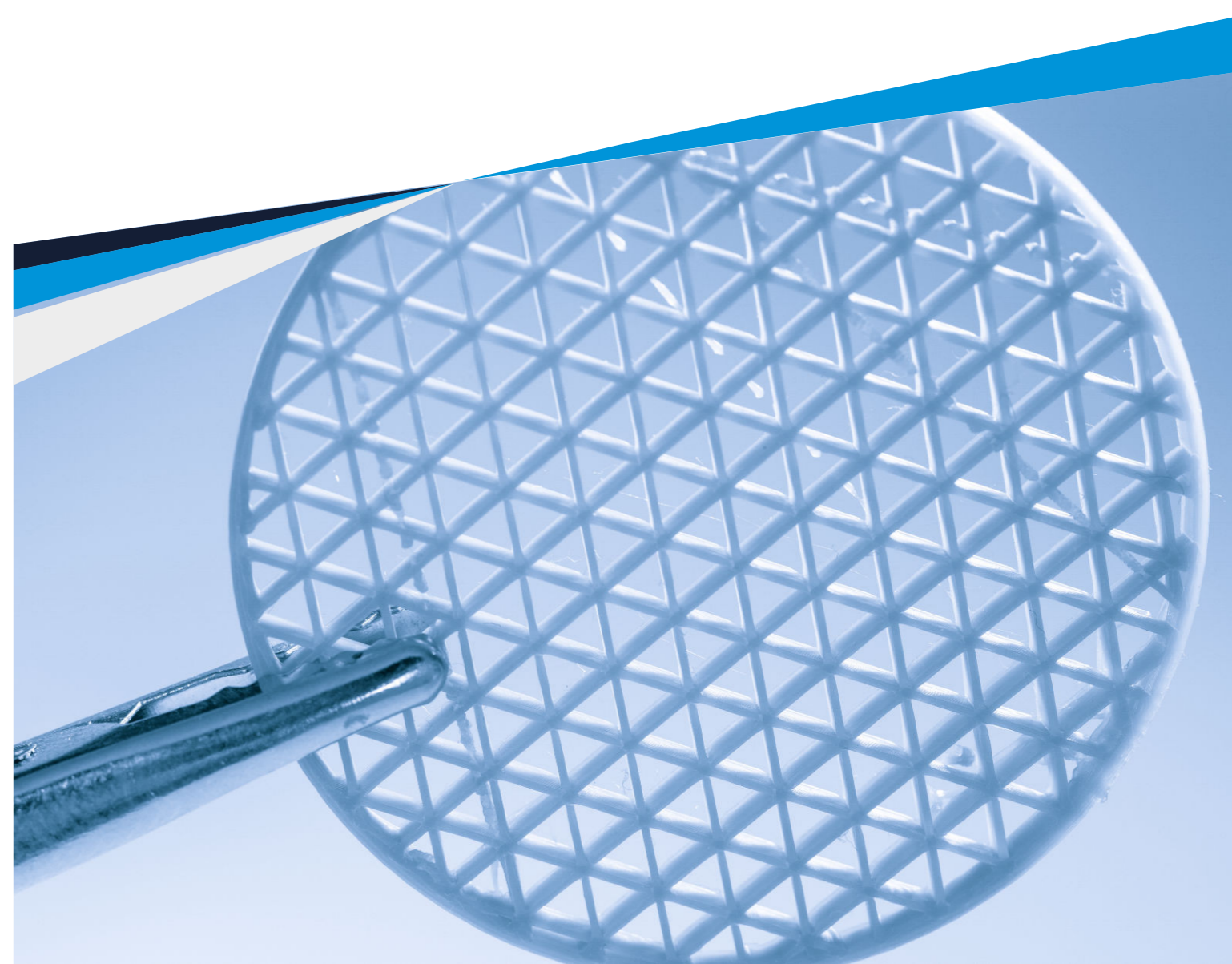
In addition, we can make electrodes with different conductive materials to cater for biocompatibility and bioinertness.



3D printed and subsequently metallized, monolithic testsocket with heat resistant polymer body and integrated metallic leads.

ELECTRONICS, MEMS & OPTICS PACKAGING

While AM is not typically considered a mass-production technology, the reduction in the size of electronics and optics – and the accompanying shrinkage of packaging – has made it a viable production alternative for MEMS and optics housings for small to medium batch sizes. In addition to the precision offered by micro-AM, and the ability to build geometrically complex housings, an intelligent use of our post-processes can increase the functionality of the packaging, for example by reducing stray light in the infrared, providing EMI shielding, or by having integrated electrical conductors.



ENVIRONMENTAL RESISTANCE

The ability of our in-house 3D coating technology to add environmental resistance to parts is important because it enables the creation of microscale devices that are more durable, reliable, and better suited for use in harsh environments — such as in the presence of aggressive chemicals and/or high temperatures. This can lead to improved performance and longer lifetimes for these devices, making them more suitable for use in a wide range of applications.

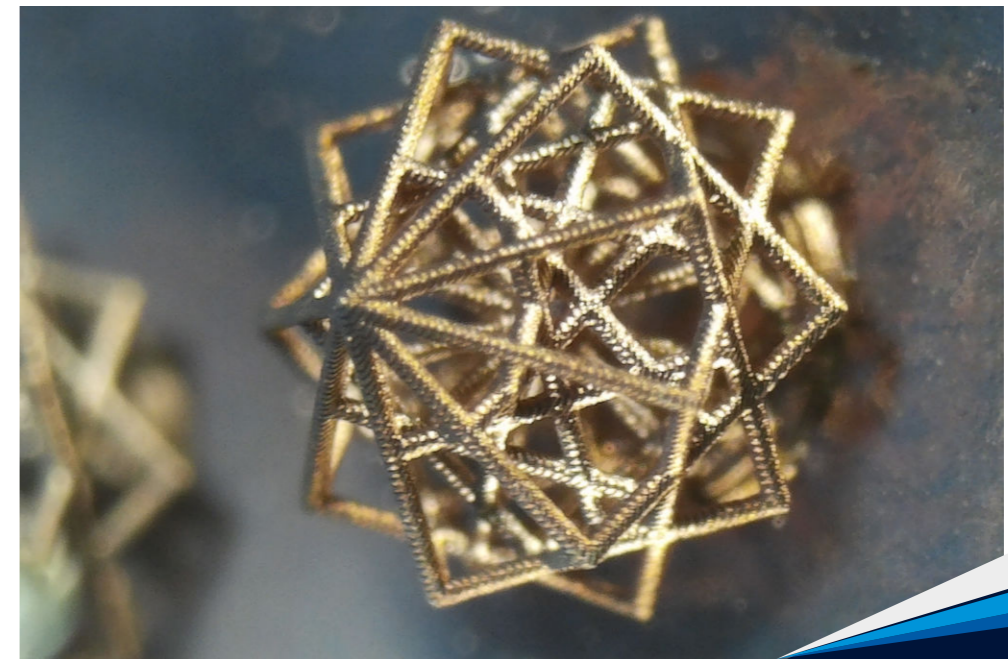
Our technology allows the combination of environmental resistance with the design freedom stimulated through the use of micro-AM for a broader range of applications than previously possible.

METAL COATING

Our in-house post-processing coating technology can wholly or selectively coat micro-AM parts with copper. By so doing, we effectively open up the resolution, tolerances, weight saving possibilities, design freedom, and other attractive features of polymer micro-AM for applications where it is otherwise not appropriate since metallic properties are required.

Copper coatings can offer significant benefits for microfabricated or micro-additive manufactured parts, but there are several challenges and problems associated with current coating solutions that Horizon has addressed to ensure the successful application of the copper. We have carefully optimized the coating process, materials, and deposition parameters, and have overcome these challenges to harness the full potential of copper coating which can now be applied reliably, cost-effectively, and speedily, making it viable for a whole range of applications.

Horizon's coatings are typically in the 1-2 micron thickness range, which is sufficient for many applications. Importantly, the company's process can also coat internal channels and undercuts to some degree, the channel's aspect ratio being the limiting factor now rather than the absolute length. This is a huge advance for copper coating of micro-AM templates.



Metal-Polymer hybrid part with octet-truss like geometry for optimization of weight/load-bearing-capacity tradeoffs.

WORKING WITH HORIZON



We are flexible in the way that we can work with you, and offer various levels of service which can be tailored to the specifics of your requirements or applications.

OPTION 1.

You come to us with a general idea of the attributes and functionality of the part(s) you require, and we assess the requirements, design the part, and produce the parts for you in-house.

OPTION 2.

You come to us with an existing drawing or design. We assess the design in respect of manufacturability and appropriateness for the optimal application of our post-process coatings. If the design passes both these assessments, we proceed to in-house 3D printing and part coating. If not, we work with you to optimise the design in order to produce end-use parts with optimal functionality in a timely and cost-effective way.

OPTION 3.

We can act as your product development partner in a variety of 3D microfabrication projects from conceptual design, provision of a demonstrator / prototype part, sourcing of a production capability, mass production, and new product introductions. We have experience in two-photon polymerisation, precision 3D printing, LIGA, electroplating, selective glass etching, reactive ion etching, maskless lithography, semiconductor foundry processes, micro injection molding, and nano-imprinting. For services we do not have in-house, we work with third parties and manage the project on your behalf so we remain your one-stop-shop and single point of contact.




REACHING OUT

The team at Horizon is available at any time to discuss how our technology can be used to the benefit of your applications. Please reach out and we can discuss your projects and move towards a mutually rewarding commercial collaboration.

Let Horizon help you to realise the opportunities on your horizon!

Contact us for more information

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