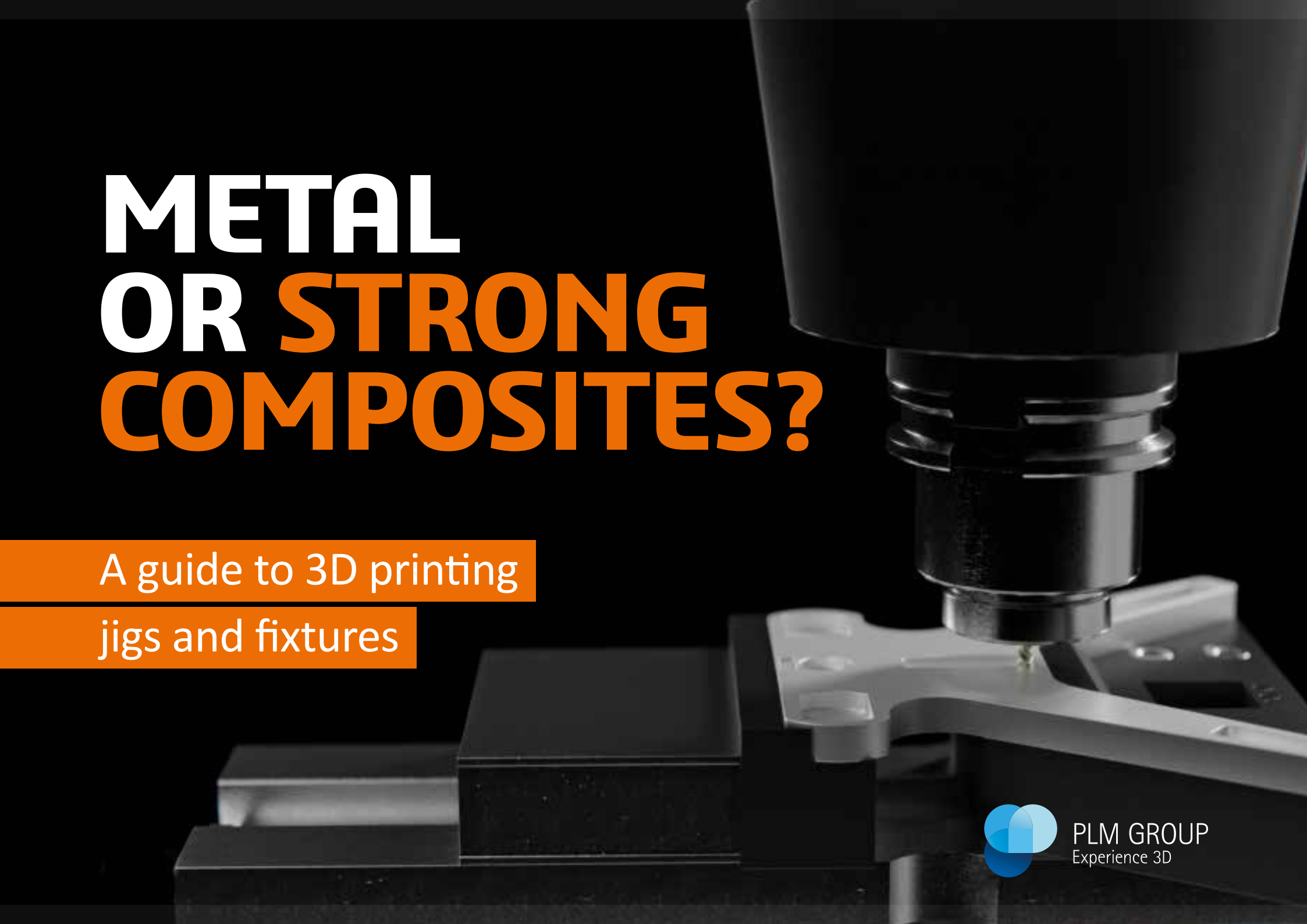
METAL OR STRONG COMPOSITES?

A guide to 3D printing jigs and fixtures



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INTRODUCTION

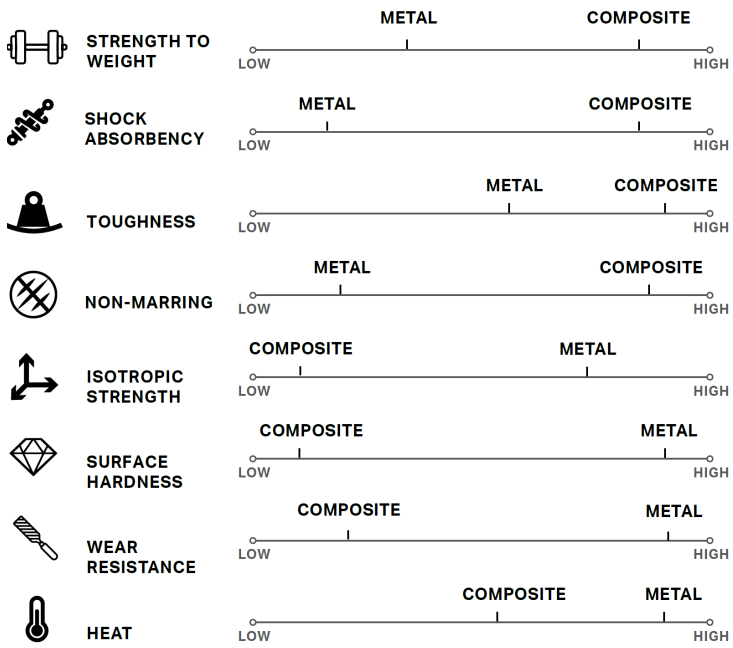
Address More Manufacturing Challenges

Both high-strength composite 3D printing and metal 3D printing are valuable fabrication methods. Used separately, they address a broad spectrum of manufacturing use cases. Together, they enhance each other and provide clever solutions.

In this ebook, we will discuss several ways in which you can leverage these complementary technologies from the 3D printer developer Markforged to quickly improve your manufacturing processes.

Markforged composite printers uniquely embed continuous reinforcing fibers — carbon, fiberglass, or Kevlar — to print parts up to 23 times tougher than ABS, while Markforged metal printers fabricate metal parts in stainless steel and other metal materials.

Each printing technology leverages the advantages of additive manufacturing to create parts suited for different aspects of the manufacturing process. By understanding their strengths, you can maximize the utility of high-strength 3D printing in your operation.



OPTIMIZE YOUR PARTS FOR SPECIFIC QUALITIES

Metal and high-strength composite parts have varying material properties that lend themselves to different applications.

TAPPING FIXTURES

Use printed composite workholding to align and support printed metal parts that require postprocessing techniques like tapping. This metal part sits in a conformal composite fixture that orients the holes vertically for easy tapping. The tough composite fixture easily withstands the clamping forces applied by the vise to secure the part.

Print Complex Metal Parts

While all parts require design, metal 3D printing allows you to print part geometries that are expensive or impossible to machine. Printed metal parts can be post processed with conventional metal fabrication processes like tapping or machining. However, with the freedom to design intricate metal parts comes a problem — the more complex the part, the less likely standard workholding can hold it. Composite 3D printers enable fabricators to manufacture high-strength conformal workholding without consuming machine bandwidth. With them, you can produce low-cost tooling and fixturing capable of handling high loads and machining fluids. For low-volume metal parts, printing both the metal part and the high-strength composite fixture will simplify your workholding design process while ensuring a perfect fit.

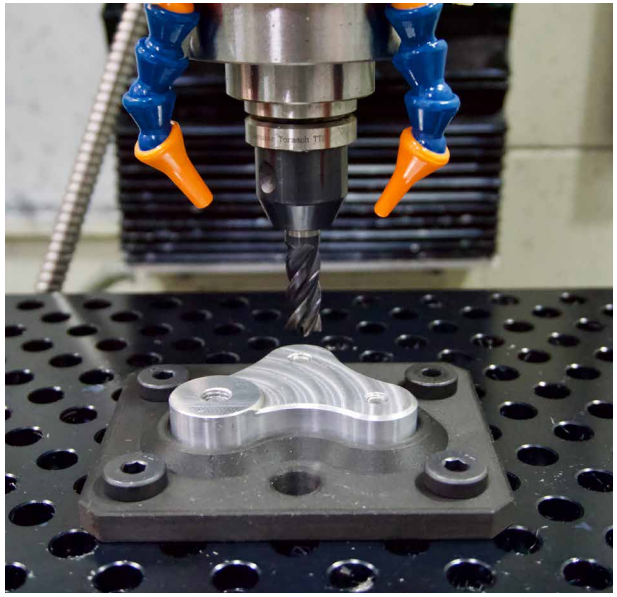
Effectively Hold Uniquely Shaped Parts

If you can print a part in metal, you will be able to easily print its composite workholding. Printing composite fixtures for metal 3D printed parts solves the conformal workholding problem efficiently — whether for tapping, post machining, or QA inspection.

Simplify Your Design Process

3D printed workholding is faster and simpler to create than its machined counterpart. 3D printing these also means you can do iterations to continuously optimize your jig or fixture.

First, CAD a fixture blank in your preferred program. Then, import your part, orient it, and perform a boolean subtract operation. The result will be a fixture that you can simply print, as opposed to the programming and machining process of traditional soft jaws.



CNC MILL SOFT JAWS

In this example, a machinist uses custom-printed workholding to fixture a metal 3D printed bearing block that requires post-machining for precision. The conformal composite soft jaws match the complex contours of the metal part. The composite jaws are tough and chemically resistant, making them durable in the machine shop.

CUSTOM WRENCHES

A metal 3D printed insert fitted within a composite grip localizes hardness and wear resistance to the contact area. The composite grip keeps the tool lightweight and ergonomic. Internal continuous fiberglass reinforcement makes it durable and robust, distributing the torsion loads applied from tool use.

Metal Tool Inserts for Composites

Custom tools are often expensive to create. 3D printing makes these tools affordable. Tools are often made of multiple materials to maximize performance. Many hammers, for example, have heavy metal heads and light, shock-absorbent fiberglass handles. Access to both a metal and a composite printer provides the flexibility to leverage both materials' strengths to create extremely functional tools, as illustrated in the example to the left with the custom made wrench. This wrench is made up of both printed metal parts and composite parts.

Custom, Multi-Material Tools

By printing one composite handle/mounting piece that can interface with a wide variety of metal inserts, you can consolidate an array of tools into a more compact unit. Swappable wear components also extend the lives of tools. When a handle or insert wears out, you can easily print a replacement instead of replacing the entire tool. Isolating the metal insert as a separate part allows you to rapidly iterate on its design.

Materials for Tool Requirements

Metals and composites share one key material property: they're both high-strength. Leveraging the secondary properties of each material yields strong tools that can be either hard and wear resistant or tough and non-marring. These two fabrication methods are similar in execution, but produce parts with a wide variety of material properties.

Having two different fabrication methods – one for metal and one for composites – enables you to 3D print parts for a wide range of requirements and use cases, from tooling and fixtures, to low-volume end-use parts and functional prototypes. Having access to these 3D printers inhouse means you can cut lead times drastically, and gain better cost control.

LINE INTERACTIONS

Composite and metal 3D-printed parts fill different roles on the factory floor and can work together to support production. Here, metal 3D-printed end effectors hold threaded couplings during their manufacturing process. Composite printed fixtures locate and align the couplings on the line. This is just one example of how two 3D printing technologies streamline manufacturing scale-up.

We cover your manufacturing needs

Here at PLM Group, we have extensive knowledge and experience helping Nordic manufacturing companies with finding and installing 3D printing solutions for their specific needs. Together with Markforged, we will make sure that you can leverage this great technology and quickly see the real benefits of using 3D printing.

Learn more about our offerings and sign up for cost-free consultancy on **www.plmgroup.eu**

EMPLOYEES
140
NUMBER OF OFFICES
17

REVENUE
35 million Euros

PRESENT IN
Sweden, Denmark, Norway, Finland, Iceland, Estonia and Latvia

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About PLM Group

We make our customers more successful by building capabilities to deliver better products faster. We have over 20 years' experience in helping engineers and product developers make high quality products better, faster and more cost-effectively.

We are the largest Dassault Systèmes SolidWorks partner in Northern Europe serving 5000 customers across a wide range of industries in Sweden, Denmark, Norway, Finland, Iceland, Estonia and Latvia. Common across all our solutions is fast implementation and short payback time.

In 3D printing, we work with best in class partners, such as HP, Markforged and 3D Systems. Our international team of 3D printing technicians and application engineers serve a variety of industries in automotive, oil & gas, medtech, engineering, prototyping and spare parts.

We help our customers with everything from investment tips, design for 3D printing, integration and implementation.

Feel free to get in touch if you have any questions.

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