



**HOW BOND 3D**  
**IS UNLOCKING THE FULL POTENTIAL OF**  
**PEEK FOR 3D PRINTING**

LEVERAGING INNOVATIVE NEW ADDITIVE MANUFACTURING PROCESSES, BOND3D HELPS BUSINESSES BUILD BETTER PRODUCTS IN LESS TIME AND AT REDUCED OVERHEADS.



**D**emand for 3D-printed functional components in the manufacturing sector is growing rapidly. This growth is largely driven by the availability of high-performance plastics, smarter robotics, and more data-driven manufacturing processes.

Among the most important developments in additive manufacturing is the increasing popularity of polyether ether ketone (PEEK). The semi-crystalline thermoplastic is well known for its high strength and resistance to heat and wear to the point that it can even substitute certain metals.

However, while the material is ideal for additive manufacturing, the process needs to be strictly controlled. The design and engineering team at Bond3D have developed a proven process that helps manufacturers unlock the full potential of PEEK from prototyping to production.

## What are the main use cases for PEEK additive manufacturing?

PEEK is typically available as a filament for use in fused deposition modelling (FDM) machines or in powder form for selective laser sintering (SLS) additive manufacturing. PEEK is suitable for manufacturing parts with complex geometries, including various essential components for the automotive, aerospace, and electronics sectors.

With its impressive strength-to-weight ratio, PEEK can substitute various metals. It also offers high chemical resistance. Key applications include position units, seals, bearings, fasteners, and washers. Bond3D's process is also suitable for creating vital functioning components used in the automotive sector, such as transmission and braking systems.

## What does Bond3D's PEEK additive manufacturing process consist of?

Bond3D's PEEK additive manufacturing process broadly consists of three phases: product design, prototyping, and production. Here is an overview of the optimal process:

### #1 Product Design

### #2 Prototyping

### #3 Production

# #1 Product design

Designing the product specifically for the PEEK process is by far the most important step, since it addresses essential tolerance requirements and the most suitable form of the material for the job.

Unlocking the full potential of PEEK requires specialised design software which Bond3D uses to create a complete digital replica of the proposed component. This helps determine the most suitable features and required dependencies of the product and saves time and money when it comes to prototyping and production.

The first stage of the design phase is creating the concept. This involves coming up with a list of potentially viable ideas that can solve the challenge you wish to address. Printing with PEEK opens up the possibility to create highly personalised, lightweight, and functional designs that can align with and adapt to your product development lifecycles.

The next stage in the product design phase is determining the materials necessary to achieve optimal functionality. Until recently, PEEK had the downside of being very difficult to apply in additive manufacturing due to high viscosity in its molten state and semi-crystalline structure in its natural state. This means it shrinks during solidification. This is why it is important to adapt the process to the material, rather than the other way round. This allows Bond3D to preserve the benefits of PEEK while leveraging the cost and performance benefits of additive manufacturing.

Finally, product design addresses tolerance specifications. PEEK has many characteristics that make it suitable for functional parts required in many industries. It is also possible to print voidless components that are isotropic in strength. That said, it is still essential to accurately determine which levels of electrical insulation, temperature tolerance, and chemical resistance are required for the final product.



# #2 Prototyping

After all previous steps in the design phase have been taken, Bond3D can start printing out the first prototypes of the product. Depending on the complexity of the component being printed, there may be multiple rounds of printing, testing, and redesigning. As such, prototyping provides the answers and insights needed to begin the production phase.

The main reason for creating a prototype is to prove that the concept works. While computer-generated models can be more accurate and realistic than ever

before, they are still unable to provide all the information required to evaluate a physical prototype in an actual production environment.

There are various ways to test the prototypes. For example, physical stress tests can evaluate parts for their tolerance to pressure, flexibility, and compression. Specific industries also have unique testing requirements of their own, such as testing for heat tolerance in automotive and aerospace applications. Moreover, given the speed and cost benefit of additive manufacturing, it is

viable to deliberately break parts to find their limits and print new prototypes as required.

The final part of the prototyping phase is redesigning the prototype based on the test results. The results provide the insights needed to improve the designs and, if necessary, Bond3D can start from scratch to find a new solution. Because additive manufacturing offers the opportunity to apply changes quickly and cheaply, they can also iterate on changes easily, no matter how big or small the redesign is.



# #3 Production



The third and last phase of Bond3D's PEEK process is to make the final product. Before they begin this phase, it is vital to have carried out all the prototyping, testing, and redesigning necessary to build parts that are ready to use in a production environment.

At this point, Bond3D's design and engineering team will create an approach for producing the parts at scale and in the order they are required. PEEK 3D-printed parts typically have a very short time to market, hence the importance of properly planning the production phase.

After the final parts have been created, the next step is post-processing. This involves adding finishing touches, such as smoothing edges, painting, or adding

any extra components that might be required.

The next stage of this phase is to get everything ready for large-scale production. The design and engineering team should be able to create a perfect functioning part. However, customers often need to be able to print a much bigger series. Bond3D offers the opportunity for clients to keep all finalised products in digital stock so that they can be printed on demand.

The final step of the production process is the quality assessment. This ensures that all of the right parts are delivered with precisely the correct characteristics and that any defective parts are properly retired rather than being shipped off to Bond3D's customers.



***Bond3D is redefining the engineering and manufacturing of essential parts for the automotive, aerospace, electronics, and medical sector. Based in Enschede, Netherlands, our company uses high-performance polymers and voidless additive manufacturing to significantly reduce costs and production times.***

Find out more at [www.bond3d.com](http://www.bond3d.com) ■