Advanced Fusion Plastic Modelling

3D printing technology has drastically changed the way products are envisioned, designed, and prototyped for over a decade now. Many industry verticals have already integrated 3D printing technology while phasing out archaic and inefficient prototyping methodologies.

While 3D printing offers many benefits over traditional modes of prototyping, it has constantly been critiqued about its output quality in terms of robustness and strength. Given the nature of the design of some prototypes, 3D printed outputs do not have the strength and finish required for functional testing. Apart from this, the 3D printed outputs need to undergo manual post-processing to remove supports and uneven surfaces that further impacts time, cost, and print quality. This is true, especially with commonly used 3D printing techniques such as FDM and FFF.

Well, things are about to change with Divide By Zero's patented Advanced Fusion Plastic Modelling (AFPM) technology. AFPM leverages our deep expertise in 3D printing, material engineering and software development to deliver a technology that resolves all concerns in terms of strength, form, fit, and functionality.

Understanding current challenges

Before we go ahead, it's crucial to get a deeper understanding of the various methods of production. In today's age, most commercially manufactured polymer commodities are made by injection moulding technology, which is as dated as the polymer technology itself. Conventionally, they are made with various pre-designed prototype moulds and are mass produced as needed. 3D printing, on the other hand, relies on developing the object layer by layer on a linear plane dictated by the design. Needless to say, they are two manufacturing processes with stark differences in the way they operate and the benefits they offer.

In the current 3D printing scenario, traditional additive manufacturing processes such as FDM and FFF are popular due to the sheer number of machines that support them. Apart from this, a huge number of machines are owned by hobbyists who are usually content with the output quality rendered. Another chunk of users have come to terms to with output quality delivered by these processes and have developed elaborate post-processing steps to reinforce build quality. By far, no one has compelled to challenge this and find out ways to fix issues at a grassroot level.

On the higher end of the spectrum, you have additive manufacturing techniques such as Selective Laser Sintering (SLS) which use laser technology to deliver unmatched precision and output quality. However, we're all aware of the price tag associated with these machines. They are simply out of reach for SME, prosumers, and hobbyists, forcing them to stick to affordable forms of 3D printing.

Due to these factors, there is gaping divide between the expected and the actual output quality delivered by traditional additive manufacturing techniques. In a nutshell, if a technology is popular and has mass user adoption, it isn't necessarily the best option out there. While FDM and FFF do a great job of 3D printing prototypes, there are some irregularities associated with them. Poor output quality and strength making it unusable for commercial applications, especially functional testing. In the following section, we take a quick look at the challenges with these traditional processes.

- Poor accuracy which leads to bad fitment and wastage of print material
- Longer turnaround time as users need to slow down the printing process and spend countless unproductive hours on post-processing
- Poor finish with visible layers leading to unappealing aesthetics

Introducing, Divide By Zero's Advanced Fusion Plastic Modelling (AFPM)

What is Advanced Fusion Plastic Modelling (AFPM)?

Advanced Fusion Plastic Modeling (AFPM) is a revolutionary 3D printing technology developed in-house by Divide By Zero Technologies, Navi Mumbai, India. This patented technology is based our years of experience in 3D printing, deep understanding of material engineering and optimised software development to remarkably improve strength, form, fit, and functionality of printed objects.

While the basics of AFPM are still rooted around traditional additive manufacturing techniques, under the surface, it is a far more superior technology. This technology by Divide By Zero relies heavily on intuitive automation and smart software application to automatically determines potential pitfalls, take corrective measures and minutely calibrate the extruder to optimise the movement and flow to deliver an output quality far superior to all other FDM and FFF 3D printers currently available in the market. In fact, you get a print quality that is comparable to the one you can expect from an SLS 3D printer.

Aion 500 - Massive Size & Ultimate Precision Industrial Grade 3D Printer

The AFPM technology has already been successfully integrated into the massive Aion 500 series of 3D Printers manufactured by Divide by Zero Technologies giving it an edge over all

FDM printers in terms of strength and output quality. The Aion 500 has already been integrated in some of the leading tech companies and design firms in India.

How does Advanced Fusion Plastic Modelling (AFPM) work?

Current 3D printers use constant temperature to melt print materials and build parts layer-by-layer. The flow of the molten material is constant across the geometry of the part, regardless of the design demands. Our AFPM technology helps control the flow and temperature of the material being printed on the basis of the part's geometry. This results in better adhesion between layers and increases overall component strength without hampering print quality, while delivering highly accurate 3D printed components. Advanced Fusion Plastic Modelling achieves this by following the three steps:

1. **Layer feature size recognition, temperature estimation and control**
   In this step, the slicing software reads various aspects such as length and temperature of the layer embedded in the gcode to intuitively work with the PID controller and heater to automatically improve and optimise required temperature of the molten material.

2. **Material flow deposition estimation and control**
   In this step, the slicing software reads various aspects such as the length and flow rate of the layer embedded in the gcode to smartly work with the flow control subroutine to automatically improve extrusion movement for accurate material deposition.

3. **Extrusion failure repair and control**
   In this step, the slicing software reads various aspects such as the length and extrusion length for current line to monitors amount of material consumed by the machine. Based on this information, the AFPM technology attempts run self-diagnostics to repair the flaw or proceed to safeguard the extruder head by notifying the user with an error message.

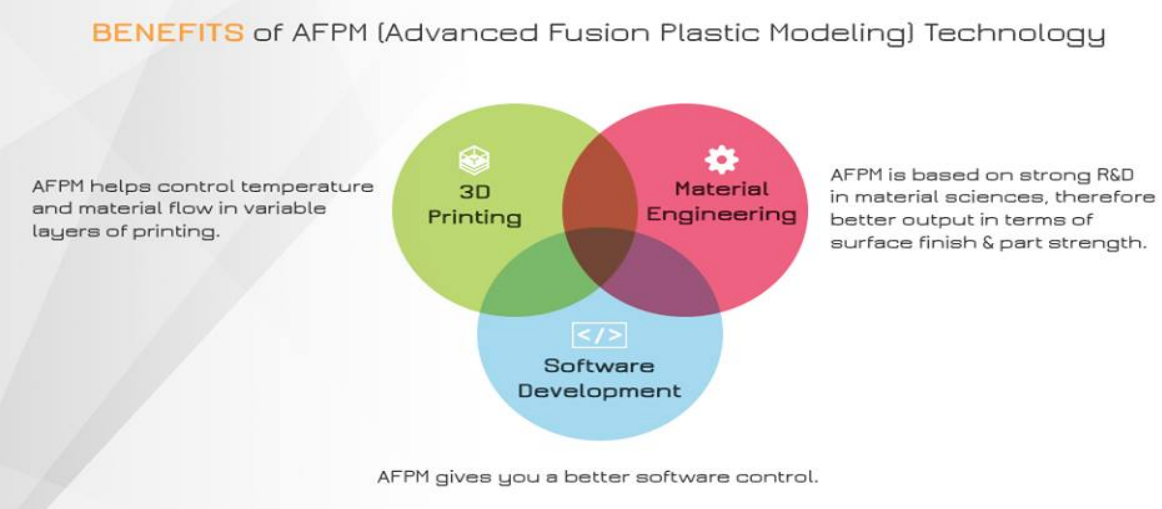
What are the advantages of Advanced Fusion Plastic Modelling (AFPM)?

1. ***Adaptive Flow-rate and Temperature control:*** Every layer of the sliced component has its own significance considering the highly complex designs and defines the overall finish of the complete component. AFPM technology auto adjusts the material flow rates at every odd and even layers of the built component, based on its geometrical stress requirements.

2. ***Superior Material Strength:*** AFPM Technology matches the industrial requirements of the built materials by complying the thermal, elasticity, and RA value requirements along with boosting the mechanical properties of the part. In some test results, it has excelled in performance in respect to parts strength even in comparison with objects printed in the much superior SLS process. The materials supported in AFPM are not the same filament spools used in the conventional FFF

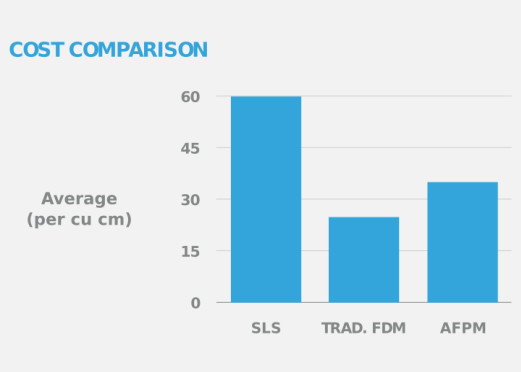
process; they are much-improved versions of these materials.

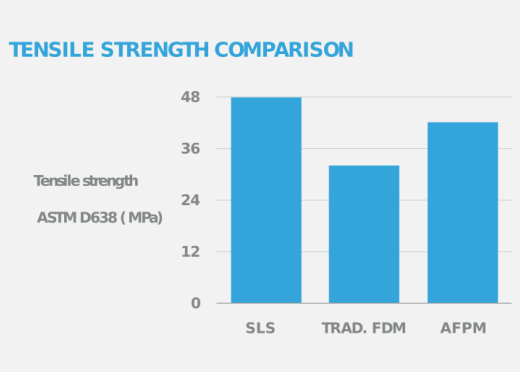
3. ***Deposition Rates:*** For additive manufacturing of parts with large volumes i.e. volumes equivalent to or higher than 500x500x500mm, it is crucial to enhance the material deposition rate. This cannot be solved by merely switching to constant deposition rates as one would do in the conventional FFF process. Doing this leads to longer build times for larger volumes. AFPM Technology achieves this by selective deposition of materials, which auto adjusts the material flow based on the geometrical complexity of the part. Layers with highly complex organic structures have low deposition rates and those, without details and simple structures, are developed at almost 3x times faster deposition rates.



How is AFPM superior than its counterparts?

- It helps control temperature and material flow in variable layers of printing, which offers better material control resulting in stronger adhesion of layers thereby delivering superior printed part strength.
- It gives you a better software control as it based on geometry and minute features of the part being printed. The software helps in selecting layer temperature alteration thereby enhancing details of the printed part.
- It is based on strong R&D in material sciences which translates into better output in terms of surface finish and part strength.





The chart above gives you a clearer understanding of the benefits of AFPM over other forms of additive manufacturing.

How do businesses benefit from AFPM technology?

Divide By Zero's AFPM is perfect for any application where prototype development is done on a day-to-day basis. Whether the prototype is required for fitment testing, a snap-fit, low volume batch production, assembly testing or to merely touch and feel the prototype, AFPM will ensure supreme strength and accuracy along with lower cost even in comparison global industry players. Our estimate concludes that in an ideal scenario, AFPM can deliver world-class 3D printing for as low as ₹6/- or $0.09 - per cubic cm (based on estimation). Here are ways your business process can benefit from AFPM technology.

- ***Superior Form and Fitment:*** With AFPM, printed parts have a superior surface finish and they fit perfectly with the design offering higher dimensional accuracy of ±100 microns.

- ***Function Testing Possible:*** Prototypes developed with AFPM are strong enough to be used in functional testing. Parts printed by other 3D printers may not be able to withstand the stress conditions of the functional testing stage in product development. This gives manufacturer key insights about the parts performance in real world environs allowing them to take design and production decisions with more confidence.

- ***SLS Quality:*** Divide By Zero's AFPM technology delivers a print quality that is similar to the superior kind you can expect from Selective Laser Sintering (SLS) 3D printers that too at much lower rates. In a nutshell, you get SLS level quality at prices lower than FDM 3D printing.

- ***Faster Time to Market:*** With AFPM 3D printing, businesses can drastically reduce time to create prototypes. Products and ideas take lesser time to reach the market. This gives businesses added agility, especially in competitive markets.

- ***Cost Saving:*** One of the major benefits and value addition AFPM offers is significant cost-saving. It offers a high reduction in cost in comparison to conventional

methods of additive manufacturing. Implementing a 3D printing setup with AFPM offers great long-term value and substantial ROI.

With Divide By Zero's AFPM enriched 3D printers like the Aion 500, businesses can reduce its prototyping time and cost, achieve higher dimensional accuracy, have provisions for fitment and functional testing and even venture out into low volume batch manufacturing with immense confidence.

We hope you enjoyed reading this informational whitepaper by Divide By Zero Technologies. As India's leading 3D printing manufacturers, we regularly share useful 3D printing and additive manufacturing tips, tutorials, and other interesting editorials. Head over to **www.divbyz.com** and sign up for our newsletter.

For a free consultation on integrating 3D printers in your business, email us @ **sales@divbyz.com** or call: **+919167943604**