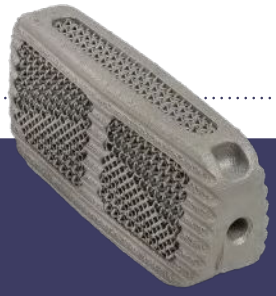
LATERAL LUMBAR (LLIF) & EXTREME LATERAL (XLIF) INTERBODY FUSION

INCREASED THROUGHPUT OF LARGE SPINAL FUSION DEVICES

HISTORY

Large spinal fusion devices are conventionally printed on smaller format machines using Powder Bed Fusion (PBF) or machined out of polyetheretherketone (PEEK) bar stock. When manufactured additively, these larger spine implants are typically printed on small format machines with a small build plate and only 1-2 lasers. They are also typically printed with their anterior face upwards in Z. This orientation in combination with the multi-step process creates a worst-case scenario. The price increases because most of the cost is driven from the production process itself. Although the cost is high, benefits that Additive Manufacturing (AM) large spinal implants are realized through the lattice design and surface roughness, providing osseointegration which leads to better patient outcomes. Another benefit to AM spinal fusion devices comes from the material. AM allows for printing in titanium with a greater fracture toughness and higher ultimate tensile strength. When produced using PEEK, these types of implants lack ideal osseointegrative features. This coupled with an unstable material supply chain creates challenges when manufacturing large spinal fusion devices using PEEK. For these reasons, producing these implants additively is often preferred.



CHALLENGES

Although AM provides greater osseointegration, higher strength materials and better patient outcomes, the manufacturing of LLIF devices on smaller platforms with 1-2 lasers increases the cost of the finished implant.

These implants are tall in Z which leads to increased build times that are further increased with a small number of lasers. When using a scraper/brush recoating process, the underside of the anterior face usually needs to be supported via breakaway supports.

The LLIFs must also be removed from the build plate using wire electrical discharge machining (EDM). The customer is charged for both processes as they are inherent in the small build capacity, low number of lasers, and traditional recoating systems.

INDUSTRY

Medical

CHALLENGE

Significantly reduce production costs when additively manufacturing large spinal implants using a multi laser system and a larger build plate

KEY BENEFITS

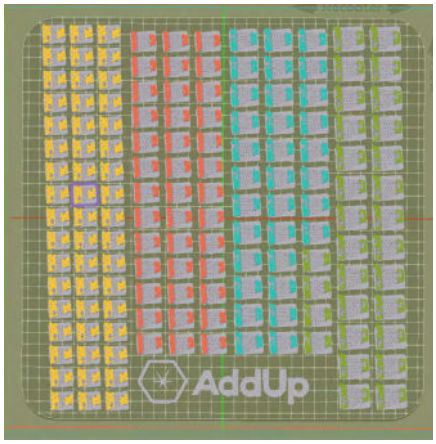
- Cut production costs by up to 30%
- Increase the output by 2.61 parts per hour
- Fine feature resolution and optimal osseointegration
- Reduced post-processing
- Lower total part cost

INTEGRATED FEATURES | REDUCED LEAD TIME | NO SUPPORT | PERFORMANCE

SOLUTIONS

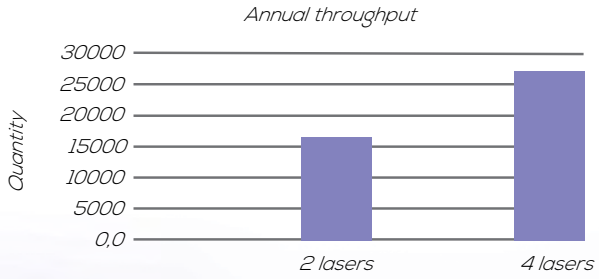
Using the FormUp® 350 PBF machine cuts production time and increases the output by 2.61 parts per hour when compared to smaller platforms with 1-2 lasers. This is thanks to a 350 millimeter squared build plate that can hold 1.5x times (152 parts vs. 96 parts) the amount of large spinal implants when compared to smaller platforms. The use of 4 lasers allows for 152 large spinal implants to be printed in just 32 hours.

The FormUp 350 utilizes a powder roller technology which allows for geometric complexity using minimal supports and results in optimal surface finish. The FormUp 350 allows for the realization of intently designed complex structures and surface roughness that contributes to better patient outcomes. There is no longer a need for a plasma porous spray or sheet based trabecular surface and the surface roughness is not a byproduct of the process. This helps to decrease the manufacturing processes required to complete a finished product. The parts come off of the printer closer to the net shape and require less manual processing and/or support removal. This combination of a 4-laser 350mm3 build volume and a near net part directly off the printer simplifies the manufacturing steps. The reduction of processes contributes to better design realization, reduced leads times, and thus lower part cost. This helps to reduce costs along all parts of the supply chain and supports more efficient patient



Top-down view with laser assignment

- Parts built per laser
  2 Lasers – 76 parts 4 Lasers – 38 parts
- Time to build on the FormUp 350
  2 Laser – 52.95 hrs
  4 Lasers – 32.35 hrs
- Annual throughput on the FormUp 350, running 1 shift per day for 52 weeks per year with 1 – 1.5 from laser off to laser on (build flip)



RESULTS

Large spinal implants produced using small build capacity, low number of lasers, and traditional recoating systems cost more than when produced using the FormUp 350. The FormUp 350 machine is ideal for medical applications like this because it provides an improved and cost-effective process to mass-manufacture highly complex medical implants.

POWDER	2 lasers	4 lasers
Medium, 30µm powder (hrs)	52.95	32.35
Annual throughput	16.845	27.408

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