

Introduction

For more than a decade from its inception, additive manufacturing technology—then called rapid prototyping—was focused largely on processing limited polymer materials, in various forms, with the exception of the Laminated Object Manufacturing (LOM) process, which utilized paper materials. As the technology set inevitably improved in capabilities and processes exceeded certain operating temperatures, new materials emerged as candidates for additive manufacturing processes, most notably metal materials..

Credit: <https://www.appliancedesign.com/articles/95633-additive-manufacturing-an-industry-growing-in-relevance-applications>

Powder Bed Fusion

The dominant commercial process for metal AM is powder bed fusion (PBF). This process employs a bed of powdered metal materials and utilizes a heat source (either a laser or electron beam) to melt and fuse layers of material powder together, to produce fully dense metal parts. PBF is synonymous with many other terms, which are either used as brand names or generically to distinguish differences in techniques such as Direct Metal Laser Sintering (DMLS), Electron Beam Melting (EBM), Selective Laser Melting (SLM), and Selective Laser Sintering (SLS)..

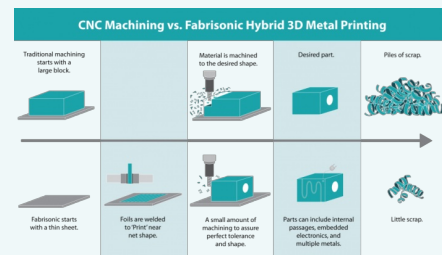
Directed Energy Deposition

The directed energy deposition (DED) process, also called direct metal deposition (DMD) or 3D laser cladding/welding is generally considered to be an important sub-sector of the metal AM industry. However, it is not a process that is conducive to “manufacturing” new/original parts, rather it is a complex additive process that is commonly used to repair existing components by adding new metal materials to the original part.

Binder Jetting

The binder jetting process utilizes two materials during the build process—usually a powder material (metal) and a liquid binder. The binder material in this process can have a significant impact on the material characteristics of the final part, meaning that this process can be unsuitable for structural parts. Furthermore, this process demands additional post processing procedures that can add significant time to the overall process.

Additive processing



Direct material jetting

Material jetting creates objects by directly jetting material onto a build platform using either a continuous or Drop on Demand (DOD) approach. For the direct jetting of metal materials, a suspension material is required.

Hybrid

Another growing sub-sector of the metal AM industry is visible in the commercialization of hybrid additive and subtractive manufacturing processes, with single hardware systems that combine additive PBF processes with CNC milling capabilities.