19AST202 AIRCRAFT PRODUCTION TECHNOLOGY

ADDITIVE MANUFACTURING IN AEROSPACE

Powder Bed Fusion (PBF) -**selective laser sintering (SLS)**

POWDER BED FUSION (PBF) The common feature of PBF processes is that they all operate on the flat surface of powdered material in a container.4 A representative example is **selective laser sintering (SLS)**, which uses a moving laser beam (moving spot) to fuse powders in areas corresponding to the CAD geometric model one layer at a time to build the solid part. SLS is illustrated in Figure. After each layer is completed, a new layer of loose powders is spread across the surface and leveled using a counter-rotating roller. The powders are preheated to facilitate bonding and reduce distortion of the finished product. Preheating also serves to reduce power requirements of the laser. Layer by layer, the powders are gradually bonded into a solid mass that forms the three dimensional part geometry. In areas not sintered by the laser beam, the powders remain loose so they can be poured out of the completed part. Meanwhile, they serve to support the solid regions of the part as fabrication proceeds. Layer thickness is 0.075 to 0.50 mm (0.003−0.020 in). The SLS process is usually accomplished in an enclosure filled with nitrogen to minimize degradation of powders that might be susceptible to oxidation (e.g., metals).

SLS was developed by Carl Deckard at the University of Texas (Austin), and SLS machines were originally marketed by DTM Corporation (DTM stands for Desktop Manufacturing), a company founded by Deckard and two partners. It is a more versatile process than stereolithography in terms of work materials. Whereas SL is limited to liquid photopolymers, selective laser sintering materials include polymers, metals, and ceramics, which are generally less expensive than photosensitive resins.

Other PBF technologies differ from SLS in the following ways: (1) heating or fusion techniques, (2) methods for handling the powders, and (3) mechanisms by which the powders are bonded into solid objects. For example, one alternative process uses an electron beam as the heating source to fuse the powders; it is called electron-beam melting (EBM).

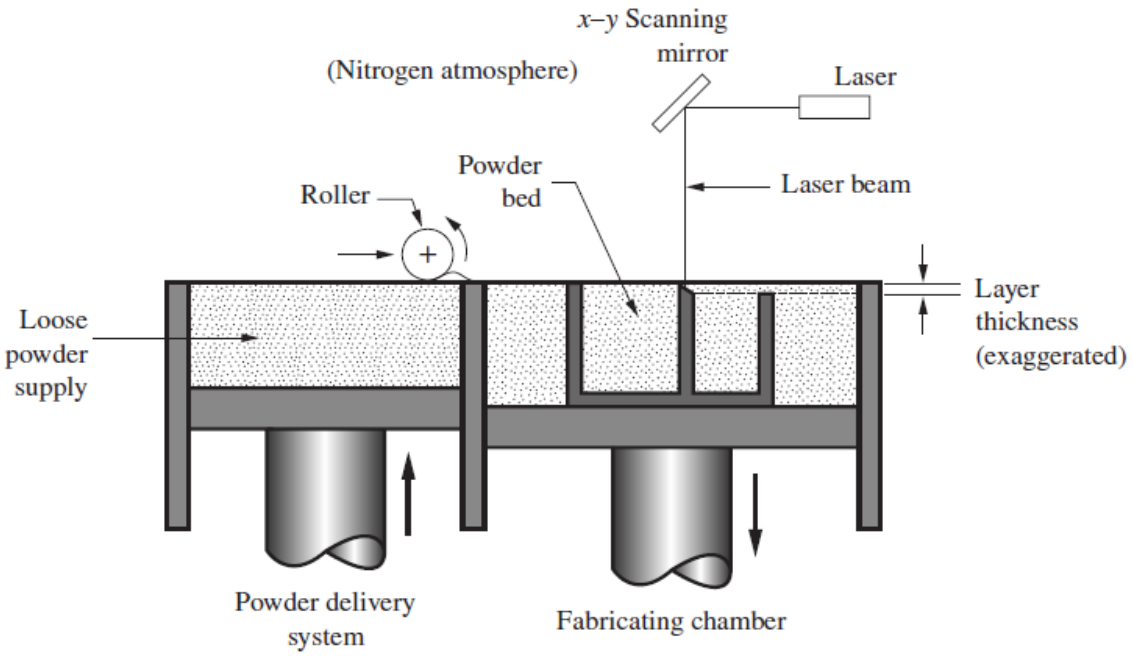

Figure Formation of a new layer in selective laser sintering (SLS).