



SNS COLLEGE OF TECHNOLOGY

**Coimbatore-35
An Autonomous Institution**

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DEPARTMENT OF AEROSPACE ENGINEERING

19ASZ401- 3D PRINTING FOR SPACE COMPONENTS

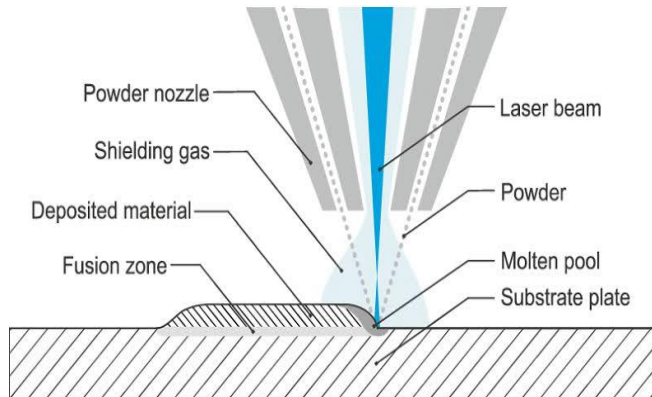
UNIT – V PRINTING PROCESSES AND BEAM DEPOSITION PROCESS

TOPIC: BEAM DEPOSITION PROCESS IN 3D PRINTING TECHNOLOGY



BEAM DEPOSITION

- Beam deposition (BO) Process enable the creation of parts by melting and deposition of material from powder or wire feedstock.
- Although this basic approach can work for polymers, ceramics and metal matrix composites, it is predominantly uses for metal powders.
- Thus, this technology is often referred to as 'metal deposition' technology.





BEAM DEPOSITION PROCESS

- Beam deposition(BO) processes use some form of energy focused into a narrow region (a beam) , which is used to heat a material that is being deposited .
- BO processes are NOT used to melt a material that is pre-laid in a powder bed but are used to melt materials as they are being deposited.
- BO process use a focused heat sources(such as a laser ,electron beam ,or plasma arc) to melt the feedstock material and build up 3-dimensional object in a manner similar to the extrusion-based process.
- Each pass of the BO head creates a track of solidified material, and adjacent lines of material make up layers.



TYPES OF BEAM DEPOSITION

1 . Physical Vapor Deposition (PVD):

- **Evaporation:** In this process, a material is heated to a high temperature, causing it to vaporize. The vaporized material then condenses on the substrate, forming a thin film.
- **Sputtering:** This involves bombarding a target material with high-energy ions, causing the release of atoms or molecules from the target. These particles then deposit onto the substrate.

2 . Chemical Vapor Deposition (CVD):

- *CVD involves the reaction of gaseous precursors to produce a solid material on a substrate. The reaction can be initiated by heat, plasma, or other energy sources. This technique is often used to deposit thin films of materials like silicon dioxide or metal nitrides.



3 . Ion Beam Deposition (IBD):

Ion beam deposition uses accelerated ions to sputter material from a target, and the sputtered material then deposits onto a substrate. This technique allows for precise control over the film thickness and composition.

4 . Molecular Beam Epitaxy (MBE):

MBE is a specialized form of beam deposition used in the growth of crystalline thin films. It involves the deposition of individual atoms or molecules in a high vacuum environment. This precise control over the deposition process allows for the creation of high-quality crystalline structures.



ADVANTAGES

- **Precision :**
Then focused beam allow for precise control over film thickness and composition .
- **Low Thermal Impact :** Compared to traditional deposition method , beam deposition minimizes thermal stress on the substrate ,making it suitable for temperature-sensitive materials.
- **Adhesion and Density :** Ion beam deposition, in particular, often result in films with improved adhesion and density.



APPLICATION :

- **Semiconductor Industry** : Beam deposition is crucial for manufacturing semiconductor, thin film transistor, and integrated circuit.
- **Optics** : It is used to create coating for lenses and mirrors.
- **Research and Development** : Beam deposition is widely employed in research labs for exploring new materials and studying their properties.



THANK YOU