

Chapter 3

3D Printing Technologies

ABSTRACT

Today, in general five different 3D Printing types of technologies exists: 1. Extrusion deposition 2. Light Polymerized 3. Powder Bed 4. Laminated Object Manufacturing 5. Wire Electron-Beam Free Form Fabrication Today technology use following materials: (a) ceramic, (b) metal, (c) sand, (d) plastic, (e) wax and (f) biomaterials. Universities and university driven companies were 3D technologies were developed. This explosive development leads to establishing tens of technologies. Some of such companies were acquired by other that kept existing 3D technology in their product palette. Boom in this field was happened in only twenty years. We expecting new technologies in coming year.

INTRODUCTION

As it is shown in Chapter 1, several 3D printing technologies have been invented since *Hideo Kodama* pioneering work at 1980s. We have technologies that use metal or plastic. Printers, which work with metal, are more expensive.

Type 1: Extrusion Deposition

Stratasys founder Scott Crump invented FDM Technology more than 20 years ago, and Stratasys has continued to lead the 3D printing revolution ever since, developing a range of systems that appeal to large manufacturers, designers, engineers, educators and other professionals.

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3D printers that run on Fused Deposition Modeling (FDM) Technology build parts layer-by-layer from the bottom up by heating and extruding thermoplastic filament, see Chapter 1. The process is simple:

- **Pre-Processing:** Build-preparation software slices and positions a 3D CAD file and calculates a path to extrude thermoplastic and any necessary support material.
- **Production:** The 3D printer heats the thermoplastic to a semi-liquid state and deposits it in ultra-fine beads along the extrusion path. Where support or buffering is needed, the 3D printer deposits a removable material that acts as scaffolding.
- **Post-Processing:** The user breaks away support material or dissolves it in detergent and water, and the part is ready to use.

The technology is clean, simple-to-use and office-friendly. Supported production-grade thermoplastics are mechanically and environmentally stable. Complex geometries and cavities that would otherwise be problematic become practical with FDM technology

FDM Technology uses the same tried and tested thermoplastics found in traditional manufacturing processes. For applications that demand tight tolerances, toughness and environmental stability – or specialized properties like electrostatic dissipation, translucence, biocompatibility, VO flammability or FST ratings – there is an FDM thermoplastic that can deliver.

The exactly equivalent term, Fused Filament Fabrication (FFF), was coined by the members of RepRap project. Third name for the same technology is Plastic Jet Printing (PJP).

Robocasting or Direct Ink Writing (DIW) is an additive manufacturing technique in which a filament of “ink” is extruded from a nozzle, forming an object layer by layer. Although it is often valuable to have ceramics and metals in the same device, joining them together is difficult-differences in heat expansion often cause cracking where the materials meet. One possible solution: Moving gradually from one material to another to spread the stress evenly, and yield a more stable joint. A new rapid prototyping technique developed at Sandia National Laboratories in Albuquerque, N. M., called robocasting, builds up hybrid parts by dispensing small amounts of ceramic slurry. By mixing more non-ceramic material into the slurry over time, Sandia’s robot makes a graded part. Engineer *Joe Cesarano* says the robocast pieces,

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