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3D Printer Ceramic Technology

Javvad Ur Rahman Khan, G. Rakesh Kumar, Dr. P. Sammaiah

javvadkhan07@gmail.com, rakeshraky.mech@gmail.com, pullasammaiah@gmail.com

Abstract*— *3D printing (also known as Additive Manufacturing Process, AM) is any of various processes used to make a three-dimensional object without the use of dies, molds or machining. In 3D printing, additive processes are used, in which successive layers of material are laid down under computer control. These objects can be of almost any shape or geometry, and are produced from a 3D model or other electronic data source. A 3D printer is a type of industrial robot.

3D printing Ceramic in the term's original sense refers to processes that sequentially deposit material onto a powder bed with inkjet printer heads. More recently the meaning of the term has expanded to encompass a wider variety of techniques such as extrusion and sintering based processes. Technical standards generally use the term additive manufacturing for this broader sense.

Index Terms—3D printing, Ceramic, without mould, without machining

INTRODUCTION

Manufacturing organizations today have to deal with criteria involving multiple Advanced Manufacturing Systems, such as 3d printing technology or also Known as Additive Manufacturing Process. The design is specifically for printing in clay but could be adapted to work with other materials. Many other self build 3D printers use parts printed in plastic but with this project I did not want to be reliant on already having access to 3D printers. It is widely believed that 3D printing or Additive Manufacturing (AM) has the vast potential to become one of these technologies.

The most basic, differentiating principle behind 3D printing is that it is an additive manufacturing process. And this is indeed the key because 3D printing is a radically different manufacturing method based on advanced technology that builds up parts, additively, in layers at the sub mm scale. This is fundamentally different from any other existing traditional manufacturing techniques.

There are a number of limitations to traditional manufacturing, which has widely been based on human labor and “made by hand” ideology rooting back to the etymological origins of the French word for manufacturing itself. However, the world of manufacturing has changed, and automated processes such as machining, casting, forming and molding are all presently working processes,
Complex processes that require machines, computers and robot technology.

However, these technologies all demand subtracting material from a larger block whether to achieve the end product itself or to produce a tool for casting or molding processes and this is a serious limitation within the overall manufacturing process.

For many applications traditional design and production processes impose a number of unacceptable constraints, including the expensive tooling as mentioned above, fixtures, and the need for assembly for complex parts. In addition, the subtractive manufacturing processes, such as machining, can result in up to 90% of the original block of material being wasted. In contrast, 3D printing is a process for creating objects directly, by adding material layer by layer in a variety of ways, depending on the technology used.
3D PRINTING

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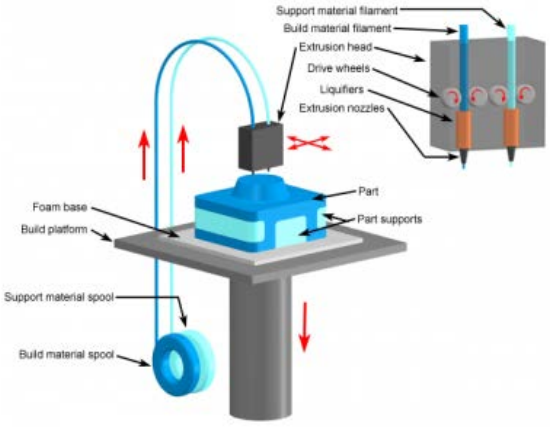

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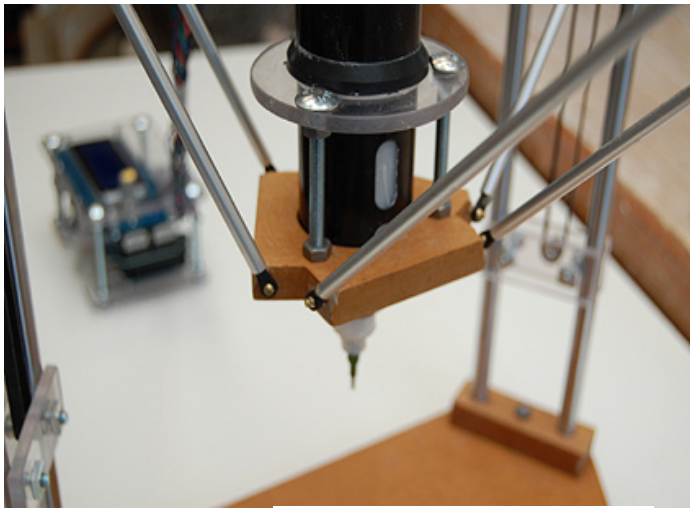
In contrast, 3D printing is a process for creating objects directly, by adding material layer by layer in a variety of ways, depending on the technology used. Simplifying the ideology behind 3D printing, for anyone that is still trying to understand the concept (and there are many), it could be likened to the process of building something with Lego blocks automatically.3D printing is an enabling technology that encourages and drives innovation with unprecedented design freedom while being a tool-less process that reduces prohibitive costs and lead times. Components can be designed specifically to avoid assembly requirements with intricate geometry and complex features created at no extra cost.

3D printing is also emerging as an energy-efficient technology that can provide environmental efficiencies in terms of both the manufacturing process itself, utilizing up to 90% of standard materials, and throughout the product's operating life, through lighter and stronger design. In recent years, 3D printing has gone beyond being an industrial prototyping and manufacturing process as the technology has become more accessible to small companies and even individuals.
GENERAL PRINCIPLE

MODELING

3D printable models may be created with a computer aided design (CAD) package or via a 3D scanner or via a plain digital camera and photogrammetric software. It is the process of developing a mathematical representation of any three-dimensional surface of an object (either inanimate or living) via specialized software. The product is called a 3D model. It can be displayed as a two-dimensional image through a process called 3D rendering or used in a computer of physical phenomena. The model can also be physically created using 3D printing devices. Models may be created automatically or manually. The manual modeling process of preparing geometric data for 3D computer graphics is similar to plastic arts such as sculpting. 3D scanning is a process of analyzing and collecting digital data on the shape and appearance of a real object. Based on this data, three-dimensional models of the scanned object can then be produced.



3D models represent a 3D object using a collection of points in 3D space, connected by various geometric entities such as triangles, lines, curved surfaces, etc. Being a collection of data (points and other information), 3D models can be created by hand, algorithmically (procedural modeling), or scanned. Regardless of the 3D modeling software used the 3D model (often in .skp, .dae, .3ds or some other format) then needs to be converted to either a .STL or an .OBJ format, to allow the printing "CAM" software to be able to read it. Or otherwise we can AutoCAD for modeling the object and then converted to the .STL file. This can use in 3D printer software. 3D printer software (**PronterFace, Repetire Host, Sprinter, Arduino and Marlin Firmware**) may slice the object and convert it to
"**G – Code**" Program, Extruder head moves according to the G – code Program in three dimensions.

PRINTING

Before printing a 3D model from an STL file, it must first be examined for "manifold errors," this step being called the "fix up." Especially STLs that have been produced from a model obtained through 3D scanning often have many manifold errors in them that need to be fixed. Examples of manifold errors are surfaces that do not connect, or gaps in the models. Examples of software that can be used to fix these errors are Mesh Lab, netfabband Mesh mixer, or even Cura, or Slic3r.

Once that's done, the .STL file needs to be processed by a piece of software called a "slicer" which converts the model into a series of thin layers and produces a G-code file containing instructions tailored to a specific type of 3D printer (FDM printers). This G-code file can then be printed with 3D printing client software (which loads the G-code, and uses it to instruct the 3D printer during the 3D printing process). It should be noted here that in practice the client software and the slicer are often combined into one software program. Several open source slicer programs exist, including Skein forge, Slic3r, and Cura-engine as well as closed source programs including Simplify3D and KISSlicer. Examples of 3D printing clients include Repetier-Host, ReplicatorG, Print run/Pronterface and Cura.

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The 3D printer follows the G-code instructions to lay down successive layers of liquid, powder, paper or sheet material to build the model from a series of cross sections. Materials such as plastic, sand, metal, or even chocolate can be used through a print nozzle. These layers, which correspond to the virtual cross sections from the CAD model, are joined or automatically fused to create the final shape. Depending on what the printer is making, the process could take up to minutes or days. The primary advantage of this technique is its ability to create almost any shape or geometric feature.

Printer resolution describes layer thickness and X-Y resolution in dots per inch (dpi) or micrometers (µm). Typical layer thickness is around 100 µm (250 DPI), X-Y resolution is comparable to that of laser printers. The particles (3D dots) are around 50 to 100 µm (510 to 250 DPI) in diameter. Construction of a model with contemporary methods can take anywhere from several hours to several days, depending on the method used and the size and complexity of the model. Additive systems can typically reduce this time to a few hours, although it varies widely depending on the type of machine used and the size and number of models being produced simultaneously. Traditional techniques like injection molding can be less expensive for manufacturing polymer products in high quantities, but additive manufacturing can be faster, more flexible and less expensive when producing relatively small quantities of parts. 3D printers give designers and concept development teams the ability to produce parts and concept models using a desktop size printer.

Note that there is one other piece of software that is often used by people using 3D printing, namely a G Code viewer. This software lets one examine the route of travel of the printer nozzle. By examining this, the user can decide to modify the G Code to print the model a different way (for example in a different position, e.g. standing versus lying down) so as to save plastic (depending on the position and nozzle travel, more or less support material may be needed). Examples of G Code viewers are G code Viewer for Blender and Pleasant3D.

finishing

Though the printer-produced resolution is sufficient for many applications, printing a slightly oversized version of the desired object in standard resolution and then removing material with a higher-resolution subtractive process can achieve greater precision. Some printable polymers allow the surface finish to be smoothed and improved using chemical vapor processes.

Some additive manufacturing techniques are capable of using multiple materials in the course of constructing parts. These techniques are able to print in multiple colors and color combinations simultaneously, and would not necessarily require painting.

Some printing techniques require internal supports to be built for overhanging features during construction. These supports must be mechanically removed or dissolved upon completion of the print.

All of the commercialized metal 3-D printers involve cutting the metal component off of the metal substrate after deposition. A new process for the GMAW 3-D printing allows for substrate surface modifications to remove aluminum components manually with a hammer.

The process of sanding is exactly as it sounds. FDM plastic parts can be sanded by hand or with belt sanders, like wood or automotive parts. Sanding is an inexpensive, effective, and proven method to reach a smooth finish. It is consistently the most widely used finishing technique for 3D-printed parts.

CONCLUSION

3d printing technology could revolutionize and re-shape the world. Advances in 3D printing technology can significantly change and improve the way we manufacture products and produce goods worldwide. The importance of an invention can be appraised by determining the which of the human needs it fulfills and 3D Printing can have an application in almost all of the categories of human needs. It will provide companies and individuals fast and easy manufacturing in any size or scale limited only by their imagination.

After the arrival of 3D Printing futurist predicted that we'd soon see them in every home. In future consumers will probably make what they want at home with their own 3D Printers. If someone wants a latest fashion toy. They will buy the 3D file instead of the product. One day we may have 3D Printer that use nanotechnology to create products by depositing them atom by atom. Simple machinery has been created at the atomic scale such as small wheels, transistors and "walking DNA". These could be the precursors to more advanced custom manufacturing system.

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