

The Impact of using 3D Printing on developing the Architectural Ceramic Design

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Abstract:

Technological progress is taking place at an accelerated pace to include all aspects of life and contribute with a great role to the well-being of peoples, and between one moment and the next there is an invention, innovation or discovery, so through the transition from one era to another, it has become impossible to stop the acceleration of new developments, and throughout all its manifestations, in the twenty-first century there will be no place for someone who does not have the causes of technology to grope the best way to show an ideas and reach out to produce a real finding prototype of this idea and to overcome the obstacles in the way, in order to provide its product and show the details of this product and its features, but also to overcome the obstacles in front of the idea that can at some points modify or distort the idea, it has become essential to fit with the production process and to materialize the idea as a producer.

The three-dimensional print is a technique that may affect humanity more than any other field of technologies existing since the perception of steam machine, light bulb, cars, airplanes, all of these technologies which have made our lives better in many ways and have opened new areas and possibilities for us, but often they took time and sometimes even decades in order to reach the stage when they could be used in an appropriate way.

The method of 3D printing unifies powders and bonding materials with unprecedented engineering flexibility, 3D printing cuts the time required to market a new product in many areas by improving product quality, combining design and manufacturing directly, and reduces product cost by reducing the cost of the development and modernization stage.

The production rate can also be increased by allocating each machine or printer to produce one type of product, so the triple printing is the next revolution in manufacturing as it is the leader in the rapid production of prototypes as well as the final parts of the product.

The advantages of triple printing in general can be summarized as follows:

1. Easy to modify design.
2. The possibility of copying designs using a digital scanning system and converting them into a three-dimensional product.
3. The possibility of obtaining large parts, protruding parts, interlocking parts, interlocking parts with an angle less than (90 degrees).

4. An integrated material recovery system.
5. Do not use many tools or devices, which reduces time and cost.
6. Limitations to design complexity.
7. Less expensive.
8. Short production cycle.
9. To obtain a product that conforms to all standard specifications, and not from the old traditional methods of defects in forming and manufacturing.

However, we will mention here the most important three-dimensional printing mechanisms used at this time:

1- Selective Laser Sintering SLS

In it, a high-strength laser beam is used to combine particles of plastic, metals, ceramics, or even glass. In this method, as shown in Figure 2, the material used for printing is in the form of powder, not a liquid, and the advantage of this technique is that the remaining material is recycled.

2- Fused Deposition Modeling

It is a simpler method that is described, as shown in Figure 3, as being a computer-controlled glue gun. Many personal printers, such as those made by Rep Rap Maker, use Fused Deposit Model technology in which ABS or thermoplastic is melted and created through a hot extrusion nozzle.

3. Extrusion formation of an organic material that is hardened with Poly-jet rays.

It is one of the few ways to support color printing and it is very similar to the idea of working in regular inkjet printers, but here you blow out a resin that hardens by projecting the UV layer of your photocopier after exiting a large number of nozzles in a printer head.

4- Formation using a laser on a liquid stereolithographic.

The method of your formation is carried out by computer control by means of a laser beam in a material that is affected by ultraviolet rays poured from a container containing it according to the three-dimensional model designed by the programs.

The 3D printer uses STL files here, which were used by the inventor of 3D printing (Chuck Hull). Most CAD programs are capable of including commercial software such as AutoCAD. As well as free software such as Google Sketch up, create STL files. 3D printer manufacturers also have their own CAD software.

5- DMLS hardening

This method is similar in its mechanism of work to the previous method, but the material used here, as shown in Figure 6, are the minerals that are in the form of powder and granules, and they certainly need to be pulverized or use of very high temperatures to bind to the metal powder.

The challenges of 3D printing:

Despite what we have mentioned of the advantages of using dimensional tripartite printing processes to design and produce the ceramic product, there are still some of the challenges facing the designer and developer of ceramic in this sector and with all the technical progress shown by printing operations and three-dimensional models, still there are variable reviews. Below there are some of the challenges facing the designer of porcelain as the field of product

design ceramic relies entirely on digital technology and computer help in getting the product of ceramic printed in three-dimensional technique, and thus without dimensional design programs and three-computers with tripartite printers' dimensions, ceramic product will not be produced, which can't be compared to the manual ways or methods of production with conventional mechanism.

2- The concept of production by three-dimensional printing has been incompatible with the concept of mass production, especially large quantities of some ceramic products, so far in terms of the production rate because the three-dimensional printing does not compete with the production rate.

Three-dimensional printing may contribute to not preserving intellectual property rights for the implementation of product designs in general and ceramic products owned by companies or individuals, especially since the designs are circulating in computers.

4. printing technology; three-dimensional technology is advanced so the designer of ceramic should be mastering it fully, its vocabulary, mechanism and secrets, more importantly, the designer has to know what can be printed using three-dimensional mechanism and design accordingly, and thus it is limited to a limited professional class of designers.

5- The cost is still relatively high, to have a product with good specifications from 3D printing ceramics, which is one of the important challenges.

6. Developing ceramic printing materials: raw ceramic used still in the stages of development, especially that there are many different kinds of ceramic raw materials, and each one of them gives different results and different products and this is considered the challenge of the biggest challenges when using the tripartite printing dimensions in the processes of design and production of ceramic products.

7. The difficulty in obtaining 3D printers despite their availability on the electronic purchase sites, due to the increase in shipping and customs expenses, as well as the difficulty of assembling them locally, due to the lack of availability of some parts in the local market.

Electronic software for 3D printing and ceramic design:

As mentioned before printing processes with three-dimensional technique depend entirely on digital design assistance CAD and digital help in manufacturing CAM to convert the design to the printing tool, the three-dimensional model which helps designer of ceramic in achieving the design in reality, we should therefore choose between appropriate computer programs to design a three-dimensional model to achieve the designers' goal and the highest levels of quality and efficiency.

All of these programs help the designer of ceramic to transform the idea in reality, and provide more help for designer generally when targeting access to design of a specific product type, such as ceramic design or engineering design with mechanical part or architectural design. There may be corporate programs that are characterized by the fact that they work on more than one concept of the previous types and thus they can be more useful and helpful to designers and design students.

Second: The programs that deal with the design for its transformation to the printer: CAM

After the designer has completed the design using any of the CAD design programs, the design files usually appear in the STL extension and this depends on the type and complexity of the program, and the STL file in the design may contain the design punch. Correcting them before the printing process in the three-dimensional printer, and here comes the role of the

CAM programs and applications that perform two basic operations, the first is to modify and repair errors of the designed shape. Second, it divides the shape of the designed model. Among the most famous applications is Slic3r which has the ability to automatically detect errors and to repair them automatically when there are simple mistakes, but can be relied upon to complete some arts altogether, but after becoming a designer of ceramic more experience in printing three-dimensional models is required as you can use modification and anatomy programs which has become more popular, and professional and there are commercially known models such as Netfabb Studio which are good for modifications and debugging for model's design and the professional version of it carries a lot of commands that help the designer in modifying a CAD model.

At the same time, it has the Slicing feature for designing as in Figure 15, so the file can be sent directly to the printer; There are also two other programs which are SKeinforge and KISSlicer and all these last applications have the main task of converting the design into slides and converting the design STL file to be produced as a code file with the extension of G-which you can implement.

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