

## Methodology to utilize CAM systems in execution of glass jewelry

**Prof. Hossam El-Deen Nazmy Hosny**

Prof. in Glass Department, Faculty Of Applied Arts, Helwan University

[Hossamnazmy6@Yahoo.com](mailto:Hossamnazmy6@Yahoo.com)

**Prof. Yasser Said Mohamed Bendary**

Prof. in Glass Department, Faculty Of Applied Arts, Helwan University

[Yaser2hm@Yahoo.com](mailto:Yaser2hm@Yahoo.com)

**Assist. Lect. Dina Said Kamel**

Assistant Lecturer in glass Department, Faculty Of Applied Arts, Helwan University

[Dinahappy84@Yahoo.com](mailto:Dinahappy84@Yahoo.com)

### Introduction:

Methodologies are an integral part of the design process. Methodology is the way or path followed to reach a certain goal, that is, the tools used to provide clues, evidences, and arguments to make sure a certain hypothesis is correct. So methodology is a plan for many processes through a set of procedures or mechanisms that can be used to observe and investigate in order to acquire knowledge and access to results and facts. The existence of the methodology supports thinking about design problems where thinking becomes more comprehensive and more useful than mental activities and intellectual skills. Thus the main importance of methodology is that it explains to the designer or design team the goal to be achieved and the course of action to be followed.

The system of execution of glass jewelry has encountered many obstacles that required searching for definite mechanisms to solve them. The research found that the CAM systems are the best ways to solve these obstacles. The computer is a tool to replace the pen to help the designer achieve unlimited solutions for constructing his ideas to reach the production programs, these infinite solutions of this system has changed the traditional features of production systems, hence, the research submits a proposal to make use of the computer systems (CAM) in execution of glass jewelry.

### Research problem:

Lack of use of CAM systems in solving the problems and applications of glass jewelry production.

### Research objective:

To activate CAM systems in a methodological setting for execution of glass jewelry.

### Research hypothesis:

By activating the potential of the CAM systems, the foundations and considerations for execution of the glass jewelry can be established with the aim of reaching a methodology for utilizing the CAM systems in their execution.

### Research importance:

Developing and enriching the field of execution and manufacture of glass jewelry using computer systems.

### **The research discussed the following topics:**

- Some research related important concepts and terms.
- Methodology for execution of glass jewelry using CAM systems.
- Applied models for the study using CAM systems for execution of some models of glass jewelry in context of the proposed methodology.

#### **1. Some research related important concepts and terms:**

Some of the important concepts were studied, such as: CAM, Computer Numerical Control (CNC), STL files.

#### **2. Methodology for execution of glass jewelry using CAM systems:**

The forum discusses the activation of the potential of digital computer systems in the field of glass jewelry execution and the extent of development that can be added in this field through the use of CAM systems in the execution of glass jewelry through the following processes (modeling – Production of glass jewelry molds - Direct configuration of the glass jewelry piece– Surface shaping of glass jewelry).

#### **3. Application models for the study using CAM systems for execution of some models of glass jewelry in context of the proposed methodology:**

Some of the designs that can be implemented for some glass jewelry products have been executed in context of the proposed methodology for execution using computer (CAM systems). Three axes have been chosen to execute the proposed methodology for execution of some glass jewelry products using computer systems as follows:

- 3D modeling by forming a waxy model to be used in mold formation processes in order to create a glass jewelry piece.
- Molding using CNC Milling for use in casting and shaping operations in order to create a glass jewelry piece.
- Formation of the surface appearance of the glass jewelry piece using Digital Printing.

#### **Research results:**

- Using the computer potentials in the field of glass jewelry execution and the extent of development that can be added in this field through **the use of CAM systems in execution of glass jewelry through the following processes** (modeling – Production of glass jewelry molds - Direct configuration of the glass jewelry piece– Surface shaping of glass jewelry).

#### **The research deduced the following results for execution of glass jewelry using CAM systems:**

- For 3D printing demonstration and display: It is preferable to use techniques such as **SLA** for display and demonstration due to the fragility of the resulting models in the production processes as well as low-cost **FDM** technology.
- For model types used in the stages of production in 3D printing: **SLS** or **DMLS** techniques can be used, because of the strength, stiffness and durability of the models resulting from those technologies.
- For model types used as a final product by 3D printing: **Binder Jetting** technology can be used as it can utilize glass as a building material, making it ideal for the primary glass jewelry

piece. **DMLS / SLM** techniques can also be used to execute metal models, making them suitable for the execution of finishing products of glass jewelry containing metal parts such as rings.

- Types of 3D printing techniques according to the type of the model design: For models with high proportions of fine details, the most appropriate techniques that can be used are **SLA, DLP, DOD** techniques, as they can perform designs with complex details and smooth surface

- Mold formation: The study used one of the digital manufacturing systems CAM for formation of molds used to execute glass jewelry.

- Treatment and finishing: The research concluded that the digital molds finishing level and accuracy are much higher than those in the traditional molds. Consequently, the resulting products have a higher level of precision and finishing. As for the primary glass pieces resulting from direct forming techniques in glass (either by drilling or cutting), they don't need further treatments or finishes.

= The proposed methodology for execution of glass jewelry using CAM systems has been activated: through production of glass jewelry using a variety of techniques based on using CAM systems in some stages of their execution: (model execution by 3D printing – molding using CNC milling – digital printing on glass)

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