

3D Printed, Self-glazed Ceramics: An Investigation Inspired by Egyptian Faience

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DECLARATION

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Abstract

This thesis investigates the potential for developing 3D printable ceramic materials inspired by an ancient Egyptian ware known as faience. Faience was produced in Egypt and the near east from the 4th millennium BC and was the first glazed ceramic material to be produced by man. Valued for its optical properties and likeness to Turquoise and Lapis Lazuli, faience was used to produce a wide range of artefacts including jewellery, statuettes and ceremonial objects for several thousands of years. It is known that Egyptian faience is difficult to work with in paste form, primarily due to a lack of plasticity, resulting from a virtually clay-free body. However, the unique composition of faience enables this material to be vitrified and glazed in one firing compared to at least two firings typically required for conventional ceramics. Additionally, some faience techniques are self-glazing, due to the fact that a glaze medium is not applied directly to the ware. Instead, glazing occurs as an inherent part of the faience material composition and processing steps.

Archaeologists have identified three glazing techniques used to produce faience. These are known as efflorescence, application and cementation glazing. This research has successfully developed and tested 3D printed faience compositions focussing in particular on the cementation method, a unique glazing technique that involves objects being packed into a ceramic container (saggar), surrounded by a glaze powder and then fired. Additionally, a highly vitrified ceramic composition was explored in combination with 3D printing. This material was initially inspired by a ceramic-glass hybrid which Victorian Archaeologists believed to be a variant of faience. However, limitations of this material led to the development of an alternative, Parian-inspired composition. This ceramic ware was developed in the 19th century and was favoured for its likeness to marble. This research has successfully demonstrated to a proof of principal stage, that 3D printing techniques can be used to overcome some of the forming issues associated with faience. Additionally, the challenges and limitations of the materials and processes developed within this research have been identified and opportunities for further research in this area have been proposed.