A Customized Inkjet 3D Printer for Ceramic Fabrication Using Sugar

Andrew Gillespie, Ben Louie Yap, Aliana Binti Shahimi, Jing Zhang*

Indiana University – Purdue University Indianapolis, Indianapolis, Indiana, USA

*Corresponding author: jz29@iupui.edu

Abstract

In this work, an open-source inkjet 3D printer for ceramic fabrication is constructed. This printer utilizes a layer-by-layer droplet interaction and heat to help bond particles with the potential for ceramic and electrical components fabrication. The primary feedstock used in this procedure is powdered, granulated sugar with a mix of alcohol and food coloring to act as a bonding agent. As an example, a logo pattern part was successfully printed. The efficiency and limitations of inkjet printing and the printing materials are discussed.

Introduction

The demand for more products through additive manufacturing has increased significantly in the past decade. Powder Metallurgy (PM) inkjet printing is one possible additive manufacturing technique that shows a high level of performance in the industry. The main expectation of this project is to expand the potential uses of powder-based additive manufacturing methods. This would allow teams to develop more robust 3D-printed components.

This project used the preliminary outline for the Design of the central unit based on a 3DP Inkjet printer designed by a Dutch engineer, Yvo De Hass [1]. The inkjet printing process applies fine binder droplets onto a powder surface, creating a desired shape. Heat then activates the binder to cure the object. Depending on the material and the properties of the feedstock used, depowering in which the unused power is removed from the area around the object [2].

Methods and Materials

The inkjet binder printing used for the research is a set process as the following. The binding agent is repeatedly laid on a powder surface to form a solid layer. After each layer is complete, the build plate is lowered by a designated distance, followed by a new layer of material added above to repeat the process, shown in Figure 1. This process continues until the entire object is done.
Compared to other additive manufacturing processes, Inkjet printing offers higher resolution. For this reason, it would increase the utilization of additive manufacturing with electronic devices [3]. While