Team 19: Smart Hybrid Pulsed-Power Electrochemical Manufacturing System

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Background

Electrochemical Additive Manufacturing (ECAM) is a metal additive manufacturing process that uses an electrochemical reaction to locally deposit material building parts atom by atom. In this process the tool head acts as the anode and build plate as the cathode. Submerged in a electrolyte fluid that contains the dissolved metal which is deposited to create 3D components.

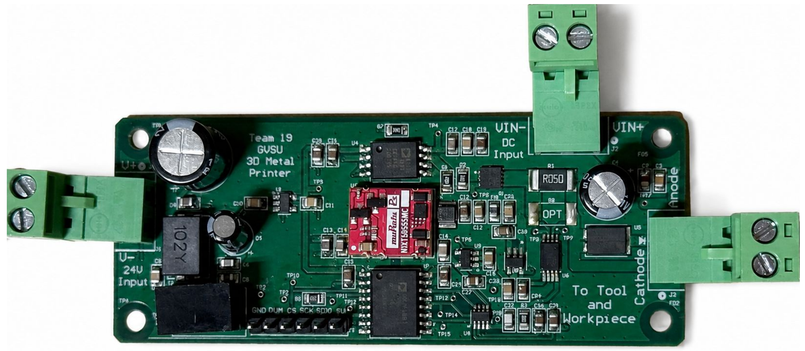
Electrochemical Machining (ECM) is a subtractive process utilizing a similar electrochemical reaction as ECAM. The same tool and build plate are used but the polarity is switched making the tool the cathode and the build plate the anode. This process is non-contact so there is no tool wear over time. It is capable of producing features on the micron scale in a wide range of metals.

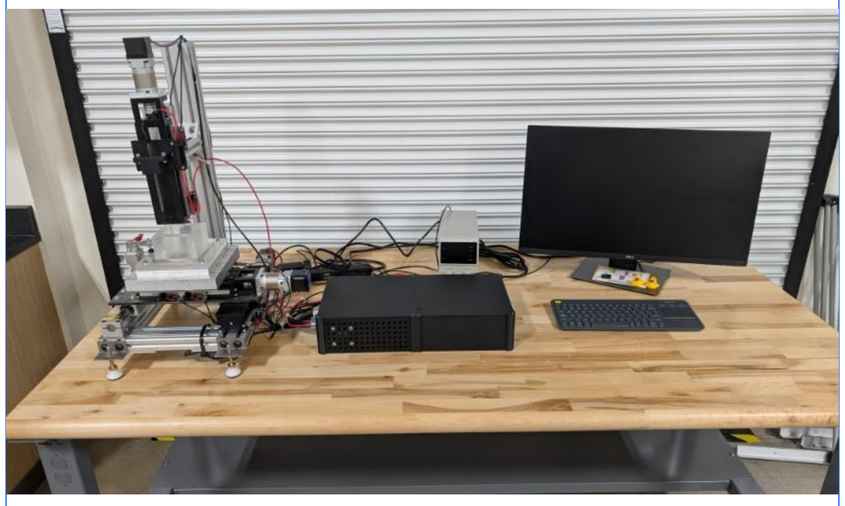
The ability to create small high precision parts on the micron scale in a wide range of materials gives this technology use cases in the electronics, aerospace, and medical industries.

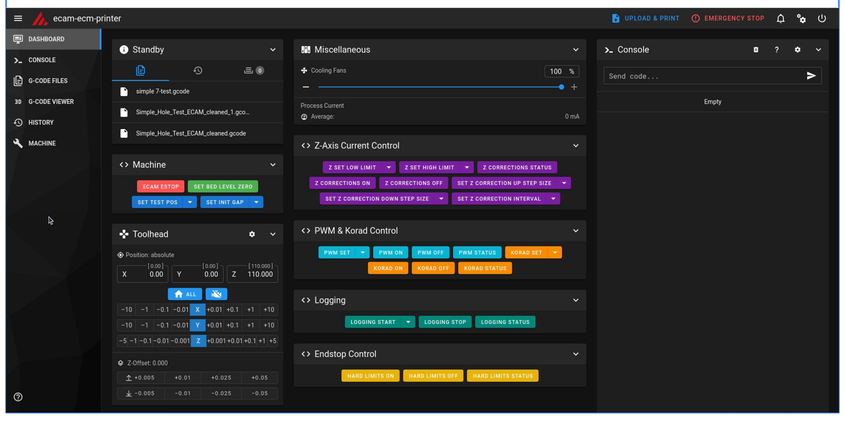
Purpose & Objective

The purpose of this project was to create a desktop size printer that combined ECAM and ECM into the same machine. The system is designed for research with an emphasis on adjustability to parameters for future experimentation and projects.

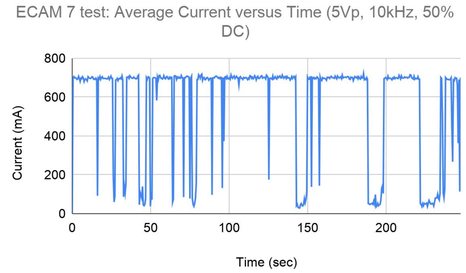
Design

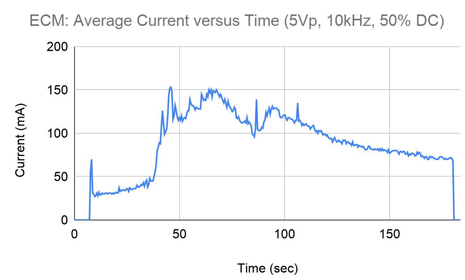


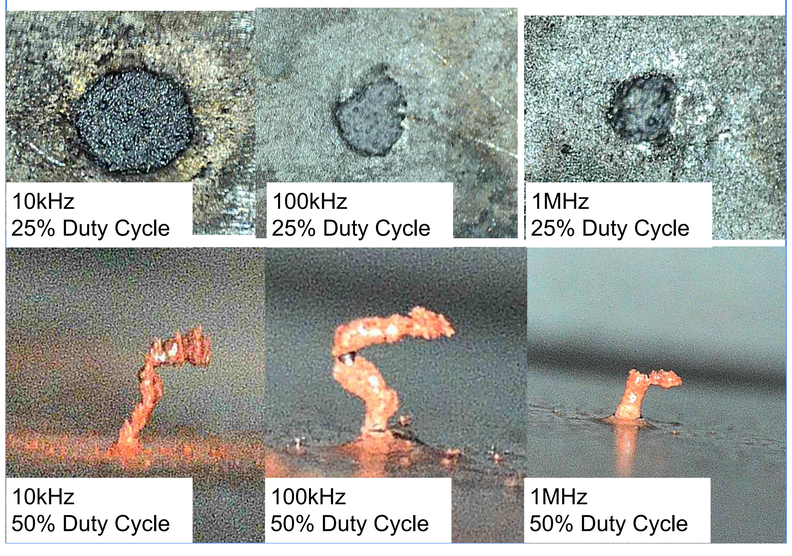




Testing







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