# *Thank you for your commitment to green initiatives at the University of Illinois. One of the ongoing requirements listed in the terms of the funding agreement for your project is the submission of semesterly reports with key information about your project. In addition to this form, please provide additional financial documentation and/or progress photos if available.*

# *Please be as accurate as possible in describing the project (including possible setbacks or challenges in meeting the initial goals of the project). Not fully meeting your project's goals will not disqualify you from making future funding requests as long as your reports are as complete and accurate as possible. If you have any questions, please contact the Student Sustainability Committee, at* [*sustainability-committee@illinois.edu*](mailto:sustainability-committee@illinois.edu)*.*

**Project Name:** Additive Manufacturing with Waste

**Date of Report Submission:** 9/17/2021

**Project Purpose:**

The purpose of the project is to find use with materials that would otherwise be discarded. The primary material being sawdust. We plan to reuse this material as a potential building material using a powder jet 3D printer. We also plan to work with other organic materials and create a new space for digital fabrication for students to explore other processes when designing.

**Detailed Accounting of Expenditures to Date:**

Office Supplies: 35.39

Academic/ Grad Hourly Wages: 1,292

Workers compensation Contribution: 8.14

Remaining: 8,464.47

**Project Progress to Date:**

Fall 2020

August/September:

* Interviewing and meeting with potential students to get involved with the project.
  + Since Covid-19 was still limiting building access many individuals weren’t able to attend in person or were currently still unvaccinated, resulting in them not feeling comfortable working in close proximity with other people.

October:

* Establishing our lab space in the ILIAD Lab. Acquiring monitors and computers that had been relocated since the lab was unused due to COVID. Reestablishing the Z Print 310 Plus, the printer we will be using for the research.

November/December:

* Attending to maintenance needs for the machine. New error codes had resulted in it not being used for an extended period of time. Using this time to understand the error codes as well as becoming more familiar with how the machine operates. This also gave us opportunity to completely flush out the system of the printer, cleaning the binder tanks, the liquid that will be the adhesive for whatever powders we use, as well as the tanks that hold the powders for printing, the current powder in the printer being a proprietary binder solution from Z-Corp a mixture of powdered plaster ingredients.

Spring 2021:

January/February/March:

* Hiring of 2 Graduate students from Architecture program, as well as introducing them to the printer and the goal of the project.
* Test prints with the binder and powders.
  + Several unsuccessful prints, software and system is running smoothly but the binder doesn’t appear to be slowing through the system successfully, resulting in weaker 3D prints.
* Additional maintenance of the machine, ordering of new tubing and filters so the machine could run smoother and more efficiently. With the hope this could lead to more successful prints.
  + The changing of these parts doesn’t seem to have changed the result of the prints

April:

* Team began doing further research into the binders that the Z- Corporation created for the Printer.
  + Recipes for the binder are unknown.
  + The only location selling the binder was located overseas and was not able to ship the binder to us at the time.
* Material tests with Sawdust, proprietary powder that was sold by Z-Corp, Sugar mixture. These powders were tested with three binders, water/alcohol mixture, Cooking Wine, and Sake (Rice Wine). The difference with the cooking wine and Sake being the amount of sodium in the Cooking wine which acts as an accelerant but can result in damage to the printers cartridges that filters material through its nozzles.
  + Sawdust
    - With the Cooking Wine, results were very fragile and easy loose. Resulting in a mixture that wouldn’t be useful as a 3D printing combination.
    - With the Water/Alcohol Mixture- Results were very similar to the original state of the sawdust, no structural changes to its composition as well as physical changes.
    - Sake- Similar results as the Cooking Wine. Fragile composition, not suitable for 3D printing
  + Z-Corp Powder
    - With Cooking wine- Top coating of the material became solid and fairly strong, cured in about and hour, significantly faster than the other binders.
    - Water/Alcohol Mixture- Not much change to the structural integrity of the material, when additional amount of the binder where applied it became stronger, but it would require an amount not possible for the printer to supply for each layer as it printed.
    - Sake- Similar to the cooking wine it became more solid just at a slightly slower cure time than the Cooking Wine.
  + Sugar Mixture
    - With Cooking Wine-Became strong with small amounts of the binder applied to much of the binder would resulting in inconsistent structures that began to expand or droop more than retain the desired shape. Cured faster than the rest in this test again.
    - Water/Alcohol mixture- The desired mixture for this powder. Easy to create the binder and leads to successful prints.
  + Sake
    - Similar results to the Cooking Wine.

May:

* Switching of the binders in the tank to some of the Cooking Wine. Resulting in the printer’s cartridge becoming damaged. Additional cartridge had to be ordered.
  + Draining of Cartridges, they’re are old Ink jet cartridges that have to be drained of their ink before they can be used for the printer.

Plans for Fall 2021/Spring 2022

* Finding new student researchers, with and outside of architecture. As well as getting students outside of the graduate school involved.
* Testing of new binder recipes and powder recipes. Ranging from prepurchase powders like plasters to organic material like coffee ground.
* Research into additional machine for powder printing, ones that are more open source and can be built by our team.
  + Creating a guide so other people at the university can add these methods to their digital fabrication spaces.
* Having a workshop for students to see the machine as well as introducing them to the ILIAD Lab as a space for additional digital fabrication research.

**Student Involvement and Outreach to Date:**

Small introductions to school of architecture through hiring and interviewing potential lab assistants but nothing openly public yet. Workshops being considered for students in the coming semester.

**Marketing and Promotion Efforts to Date:**

No promotion at the moment but when workshops are being planned they will be open to students. We are considering social media presence to bring new groups of students, students outside of architecture, to the ILIAD Lab.

**Additional Comments:**

Photos attached, showing the material tests, a tamper we made to flatten the material, and the CNC we are getting some sawdust from for the project.

A picture containing text

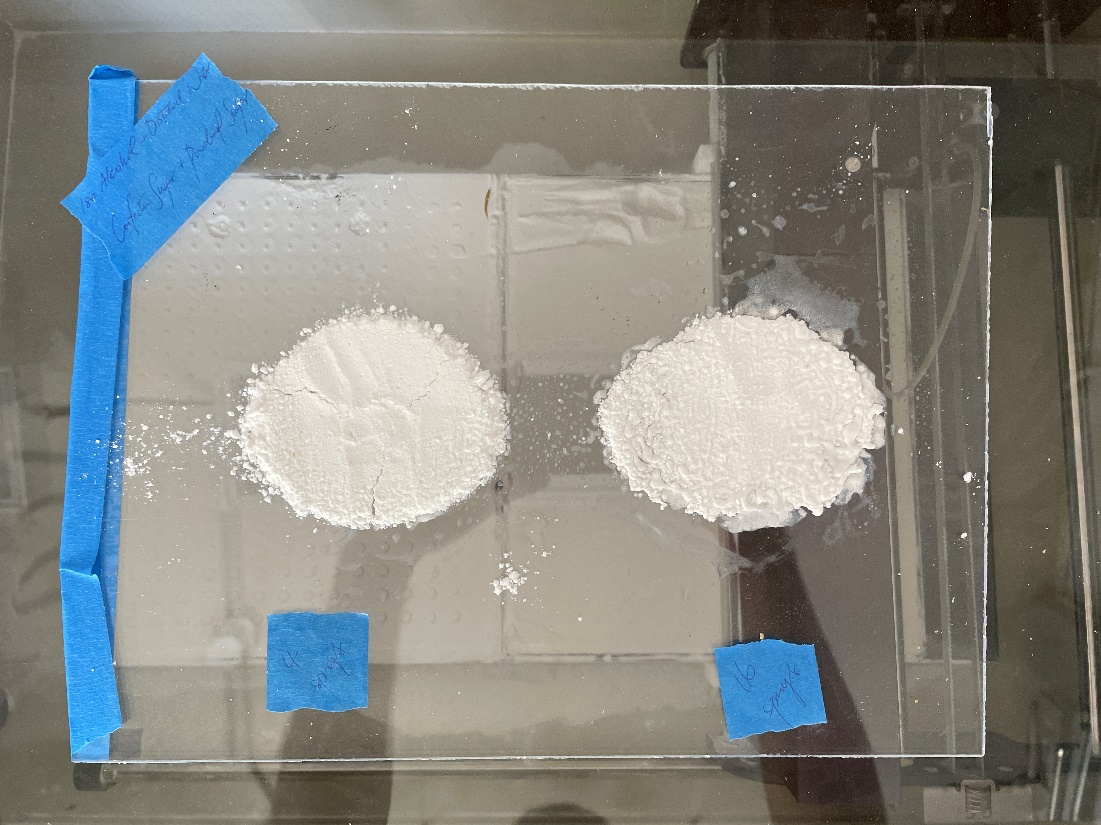
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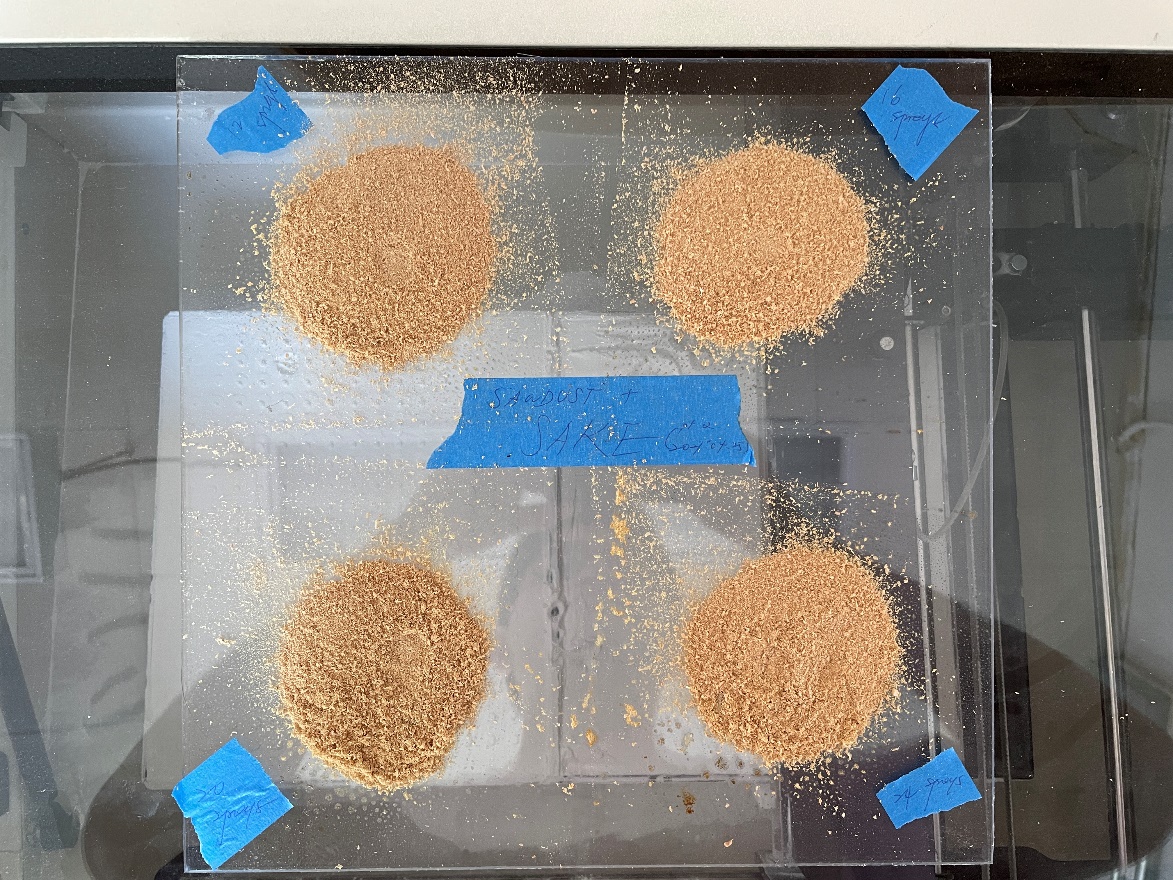
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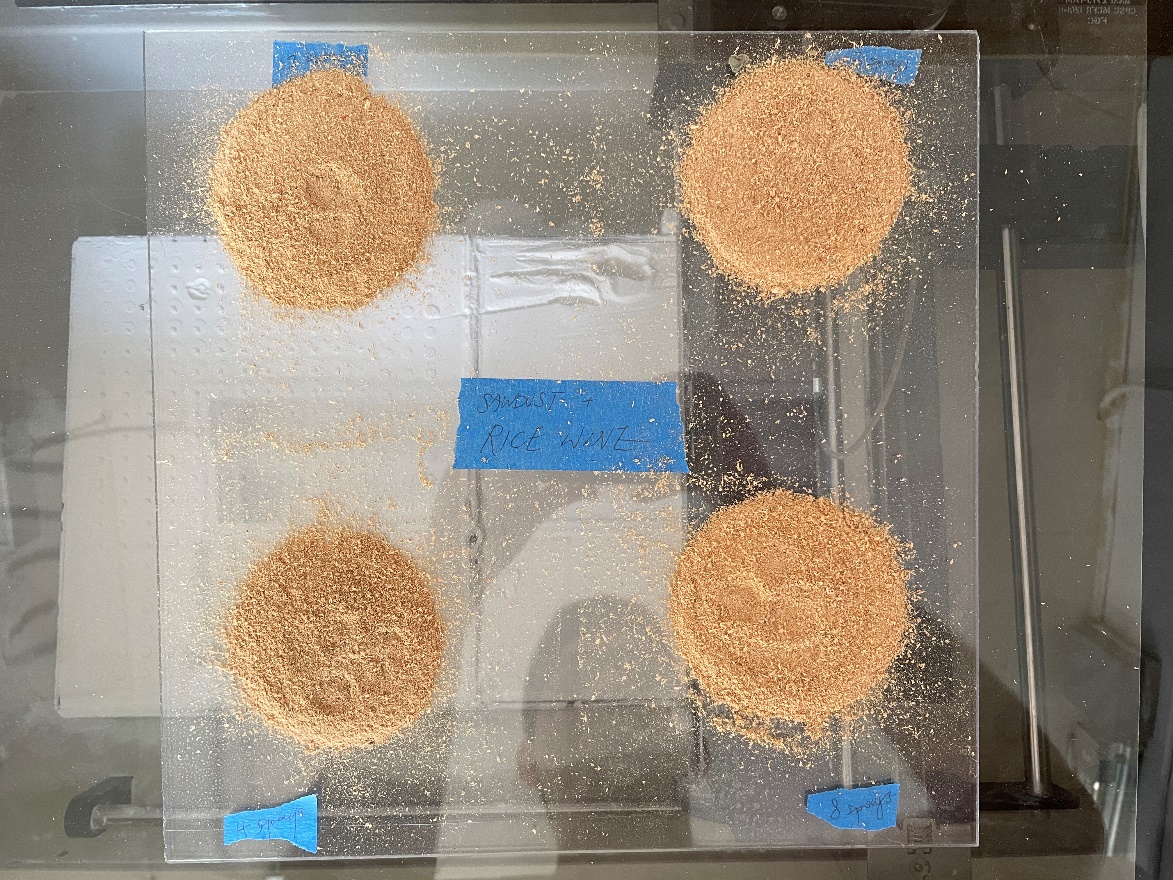
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