Project FabMX

Andreas stellt das FabMX-Projekt vor:	English introduction video:

About

The goal of Project FabMX is to design and build an affordable, open-hardware 3d printer capable of producing metal objects.

FabMX is part of MakerTools.

The Process

We want to build a "metal pellet fused deposition modelling" system. What does that mean? The material to be used is MIM (metal injection molding) feedstock. This is a metal powder / plastic mixture with a very high percentage of metal (>90%) and can be bought in the form of pellets. In a conventional MIM procress, these pellets will be heated up until the plastic (a thermoplastic) gets soft and then gets pressed into a mold that gives the object its shape, just like with (non-metal) injection molding.

To get a metal object, further processing steps are needed:

- First the plastic has to be removed from the "green" part, this is called "debinding". There are several debinding systems, usually this is done thermically (in a debinding oven) or chemically, e.g. by putting the part in an acetone bath.
- The result of the debinding step is a very brittle "brown" part. This now has to be sintered in a sintering oven. The temperature needed depends on the used metal, for stainless steel it is around 1300°C.

To turn this process into one suitable for 3d printing, the first step (injection molding) is replaced by an FDM/FFF style 3d printer, but one with a pellet extruder suited for taking MIM feedstock. The resulting 3d printed "green" parts are then debindered and sintered just like in metal injection molding.

Why?

Before Adrian Bower started his RepRap project, you couldn't buy a 3d printer for under 20.000 Euros/dollars. But his project changed everything. He designed a 3d printer that anyone could build and published all the plans under an open-source licence. Enthusiasts around the world picked up the idea, built their own machines and helped to improve the design. Soon you could buy kits by companies like Makerbot or Ultimaker, and today you can get ready-to-be-used open-hardware machines from e.g. Prusa, Lulzbot or BCN3D. From Asia you now can get 3d printer for as low as 200 dollars.

This means that the price for a 3d printer is now just 1% of what it was roughly 15 years ago.

For fablabs, makerspaces, startups and interested hobbyists this changed a lot: suddenly they got access to state-of-the-art production technology, that was only available to large firms or universities before. They now could produce their own custom parts, at a very low price. This opened up a lot of new possibilities. Just have a look at what people upload to thingiverse and ask yourself if that would have been possible without the access to a 3d printer.

But these 3d printers all have a big drawback: plastics only.

While the evolution of FFF 3d printers (and SLA/DLP resin printers) went on at an amazing speed, metal 3d printing technology is still in a "pre-RepRap stage": too expensive, only for the big players. The makers are left behind. This situation motivated us to start an open-hardware project, with which we hope to repeat (or should I say "replicate" 😉) the RepRap story in the domain of metal 3d printing. At least a little. I hope some of you come with us on this amazing journey!

What?

To make this goal happen, a couple of things need to be done:

- Designing a pellet extruder, capable of handling stainless steel MIM feedstock (and other metals)
- Finding a practical support material/system
- Finding a good binder system, which
    - is easy to print with in a pellet extruder 3d printer
    - can be debindered easily (at low cost; without highly hazardous substances)
- Finding/designing a sintering oven, which
    - can easily be run in a fablab/makerspace environment

- is low-cost
- is capable of sintering stainless steel (which probably involves vacuum and/or forming gas atmosphere)

Ideally all components should be able to be produced in a fablab/makerspace.

And then, of course, all of this has to be documented using an open-source license.

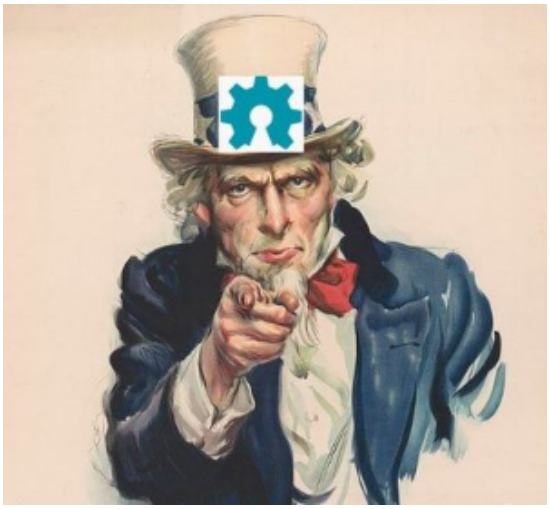
Status

We are still at the very early stages. We are building a pellet extruder for our first experiments. In parallel, we are experimenting with metal filament (basically MIM material as well, but in filament form), see how well this can be printed, and how it can be debindered and sintered.

Also, we are looking into building our own, small induction oven for sintering.

Project updates will be documented in this wiki. Follow us on twitter for news.

Get involved!



We are looking for 3d printing enthusiasts who want to support this project.

Right now we are mainly looking for people with relevant knowledge, especially in the following fields:

- Building pellet extruders
- Printing with MIM materials
- MIM binder systems (especially non-standard ones, as we need to find a low-cost debinding method that does not involve highly hazardous substances)
- Sintering ovens (especially ideas on how to get/build a suitable, low-cost one)

If you know something about there things, we would love to talk to you!

Are you are working on something similar/related? We would like to hear from you too! Co-operations are very welcome!

Are you a MIM feedstock producer? Can we have free/cheap samples?

You want to build your own pellet extruder for MIM material? We are not there yet, but get in touch! As soon we have something we would like people try to reproduce/test our designs!

Interested?

Drop us an email: fabmx@fablab-muenchen.de

Follow us on twitter: https://twitter.com/ProjectFabMX

Join our discord server: https://discord.gg/SXafhRU (channel FabMX/#fabmx_de or FabMX/#fabmx_en)

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