Notes – Sept 22

Mai: bed temperature only to prevent warping
 investigate more? Or just leave and do something else?

Anu: we all looked at bed temperature effect but didn’t see much research on effect of bonding

Chad: what do you think is going on with warping?

Mai: uneven cooling can pull the corners up from the bed

Anu: usually 1st few layers, not always throughout whole thing

 Get gaps at higher layers because of that? Effect of corners not being heated on bonding of layers above?

Chad: why debonding? What causes stresses due to printing?

 Thermal contraction? Usually lifts up when debonding

If bottom is colder than top, bottom contracted, top expanded

Mai: Hot at top contacts upwards

Chad: consolidation experiments from reading (U of C)?

 How does mtrl consolidate at diff T’s -> ABS put it on a hot plate by “sintering”

 Know answer to this

Riz: issue with pla is water absorbency, bonding is harder due to oxidation (high t’s bigger than print temp)

Chad: moisture changes properties of mtrl, that’s why it’s hard to find exact mtrl property values, humidity, details of processing

 Bed temp is not first order effect, temp that it comes out, and

 Print out material properties, and operating conditions of printer for next time

 Compare 170C to 70C, properties change exponentially over range, more happening at 170 than 70C

Mai: additives to PLA: should list as a constraint?
 test different kinds of PLA:

Chad: how’d you know what the additives are, and test how they affect properties?

 Need to figure out how one material behaves before doing multiple

Anu: if not changing material, then no use to thinking about it

Mai: are we deciding to do DSC analysis?
 get T glass, heat capacity, melting t

 Diff types of pla have different ranges, maybe trace back from DSC

Chad: maximize bonding as it’s printed
 have it all in a lit review, can do DSC trace, but what do you do with that? Why do we need the range?

 Distinct changes in behavior above and below t glass, and t melt
 can you learn anything by looking at correlation

 Mtrl out of nozzle at 170 C, where is that in relation to t glass etc

 Above and below glass transition t?

 Below -> stiff, above -> super viscous

 Need above t glass, but above t melt not viscous enough also oxidation effects

 Why is Hcap important?

Anu: determines how quick it heats up

Chad: cooling is going to be very important, need thermal diffusivity
measure characteristic properties of material

 Making that correlation, why in given temp window,

Will: generally heat bed to prevent warping, why?

Riz: thermal stresses

Will: material shrinks due to thermal contraction, highest bed t without screwing up, gives best strength

Chad: 1st order effect is filament temperature

Will” quashing = level of filament in contact with bed, higher quashing means less definition, higher surface area on. Need to maximize bonding but have a decrease in quality and definition with a much higher bed t

Chad: need a better agenda

 Need a summary of accomplishments in last week, here’s some info that we’ve gathered, here’s what we’re working on right now

 Getting anxious that we’re on the wrong trajectory. Need more work.

Riz: maximize bonding and density? Or bed temp and bonding?

Mai: don’t really need to worry about bed temperature

Chad: focus on filament temp and cooling

 Put a piece of pla onto another piece at a t for a time, how much bonding occurs?

 If I’m printing, what is my time temp history? function of time, temperature, and geometry

Will: enough energy for a higher level to heat a lower level?

Chad: need hard numbers for next time bc it’s embarrassing

 Next time needs to be better

 Uncertainty for project:

Mai: same objective, maximize density and bonding

Chad: 80% of it: if you wanted it to be most dense, just melt it

 Densify but retain shape! Be precise, recommend update objective

 Constraints: bed temp (use default print temp)

Will: Keep below t glass, otherwise overhangs will sag

Chad: fix bed, and additives and chemistry (just know what it is so could maybe translate to a different material)

 Really want to do very carefully, would have to control environment totally (humidity)

 Sometimes can store in a vacuum sealed, frozen, etc

Will: more humidity, = more bubbles in print

Turns out we have accidentally deleted all the lit that chad posted

Chad: gonna email one paper in particular (bonding with ABS – UC paper)

Mai: figure out how to measure density, designing experiment, modeling

Chad: what are you going to measure? What would you like to predict?

Anu: measure where mtrl deforms,

Riz: measure how, based on different t’s, pla bonds
measure diameter of filament, stick in a filament, and then

Chad: how the pla bonds to itself, two rods will eventually bond and be indistinguishable
time and temperature varying
predicting this, isolate one variable, an fix all others

Riz fix dimensions,

Chad: one of time or temp constant

 Time will stay same, different temperatures

Riz then make model of how temp would vary through pla

Chad have a wall of huge length, something deposited on top, does t of bottom matter?

Mai if the bottom is being heated, bottom should be roughly constant

Chad important is the top part, bonding depends on time temp

 Time temperature history of the point on top

 Start at tmax, decrease to a temperature

 Does the part heat up as it’s printing?

 Estimate time vs temperature, knewe something about bonding

 No bonding below t glass, only upper region relevant

 Higher t has faster bonding -> experiments come in

Will: pyramid happened due to not waiting during layers

Chad make assumption that part t has homogenized

Will look at sintering portion of Callister, look at powermetallurgy science by randall germanfor

 Master sintering curve

Chad sintering is not exactly same for metals and plastics

Riz sticking two rods

Chad can be a flat table, cool it, print a rod ontop, and heat together

 Function of time and temperature, bonding, etc

C think about drawing diagrams, how we’re gonna tackle this

 Simplify! As simple as possible!!

 Able to calculate is way better than no calcs

Chad more actions, better agenda, show drawings calculations, written one or 2 sentences of objectives, constraints, free vars

 Meet at any point next week

Will also email me!