

Hardware requirements and some instructions

version: 06/24/2014

1	filament-holder	LAYCERAMIC is very brittle! The coil I deliver to you, may have fractures. handle the filament as a virgin, make it warm (50°C) and it's bendable, if cold (20°C) is very breakable	
2	hobbed bolt	need to have excellent grip, should be hardened f.e. ebay: Hobbed Bolt M8 for 3D printing / Prusa / Mendel / RepRap / Hardend steel!	
3	metall guidtube	guid the filament after hobbed bolt to the inlet of your hotend,	if you have broken ends of filament, you are able to feed it in while the printer works
4	fan	need to be strong and adjustable while printing, you are able to determine how long is the "heat"zone in you hotend.	with short heat zones and higher temperatures , you reduce the necessary force to push filament in.
5	Hotend	I drilled a sink hole in my prusa-hotend to reduce !!! the lenght of contact-area (zone) between heatbloc and filament.	
6	Kiln / oven	with external temp-sensor to give a signal to the controller	
7	Controller	for min. 10 temp. ramps (steps)	Programable Temperature Controller with Timing Function
8	Printing	<p>starting:</p> <ul style="list-style-type: none"> • first, test how the material will flow trough your hotend, • heat up the hotend <u>without</u> filament ! fan need sto be on! • after reaching temp, push the (LAYCERAMIC) into the hotend only by hand, • you can feel how much force you need for pushing it in, <p>note: the bigger the hole in the nozzle, the smaller the force you will need, note: the higher the temp, the smaller the force you will need,</p> <ul style="list-style-type: none"> • but: do not rest the filament at 240°C or higher in hotend for some minutes, it will go black and hard, (reason is <u>beginning of a slow process of cracking polymer</u>, the viscosity will encrease, and is to high to flow trough the nozzle) • use a drill to cleane from nozzle side • if totally cracked (over some centimeter, drill from oposit side • <u>prevent cracking, by pulling out filament directly after your print ended or stopped.</u> <p>note: same while starting a print.</p> <ul style="list-style-type: none"> • wait until the hotend reached it's target temp (260-275°), not till then push the filament in the hotend and tight the screw pressing filament in the hobbed bolt, begin to print the raft or object first layer. 	
9	debinding	<p>for debinding the main polymer out of the clay-filled filament, heat up your object while using temperature ramps. see attached PDF. you may vary the ramps for finding better results, make the steps longer or shorter (experimental filament)</p> <p>Attention: debinder not in rooms, do not inhale the fumes, fumes are unhealthy</p>	

10	sintering	if you have enough time, use longer temperature steps than written in INSTRUCTIONS (dropbox-download)
11	designing rules for debinding	<p>print your object with</p> <ul style="list-style-type: none"> • a low number of perimeters (total wall thickness), and • low percentage of filling. This supports the debinding process. Avoid massive material thickness – blows or bubbles may occur. • make the object much smaller than the inlet of your kiln: This is recommended for better temperature distribution (while debinding) in kilns chamber and reduces shrinkage and deformations. <p>objects with big overhangs may be debinded in powder filling: means, place the printed object in a bin and fill it with stabilisation-powder: see below;</p> <p>during debinding the object will now hold its form many recipes may be possible:</p> <ul style="list-style-type: none"> • pure fine sand (will melt under 1000°C) • gipsum mixed with meal or other natural powder (no sugar!)

12	Stabilisation powder – why?	<p>Use a mix of 50% wheat flour (meal) and 50% gipsum (pure modelling gipsum, no plastic enhanced!)</p> <p>fill a flowery pot with your object and the mixed powder.</p> <ul style="list-style-type: none"> • It will stabilize your object against blowings of outgasing steam • Against bending while thermal influences <p>Why meal is inside?</p> <ul style="list-style-type: none"> • Meal will compensate the expanding effect of gipsum in the heat, • The meal part will disappear as the polymer binder too, • It will smell like in a kitchen of course • The remaining gipsum isn't compact after meal disappeared • You may remove the gipsum after firing easily, with brush and water (if your ceramic already got 850°C and is hard enough to touch and move it) <p>Big amounts of stabi-powder perhaps needs more debinding time in all periods. Make your own tests please and publish it in rewrap-network. Thank You! Have nice ideas with Layceramic!</p> <p>Yours, Kai Parthy</p>
----	-----------------------------	---

See next page

Profil: 06-2014.a + 520°

Step	target temp °C	minimum time in minutes	optional use this longer time	total time minutes	h total
1	125	60		60	1,0
2	130	60		120	2,0
3	255	60		180	3,0
4	275	120	180	300	5,0
5	370	120		420	7,0
6	412	180		600	10,0
7	515	30		630	10,5
8	545	60	180	690	11,5
9	1050	180	300	870	14,5
10	1055	60		930	15,5
hours		15,5	21,5		

