
Subject: Heart breaks too heavy
Posted by [dizingof](#) on Wed, 12 Jan 2011 13:55:01 GMT
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I just received an email from support, canceling an order of my Caged Heart

in stainless steel.

reason: Heart breaks too heavy.. yeah ! tell that to the customer !

How would one know how fix such an issue with that kind of reason... ?

Since when a 2cm model is heavy and breaks ??
Any one has a good answer to that? or how to avoid it?

Subject: Re: Heart breaks too heavy
Posted by [Youknowwho4eva](#) on Wed, 12 Jan 2011 14:06:25 GMT
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Perhaps it's a sprue issue? Looks to me like it would be hard to support the heart through the process without it or the cage breaking.

Subject: Re: Heart breaks too heavy
Posted by [dizingof](#) on Wed, 12 Jan 2011 14:17:03 GMT
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Sprue? in stainless steel printing ? this isn't silver..
a sprue is added for infusing the with bronze.. after bake.

I don't get it.

How could a designer design floating objects in stainless steel without getting weird crenelation reasons (and with no additional comments how to fix it...)?

Subject: Re: Heart breaks too heavy
Posted by [Kaetemi](#) on Wed, 12 Jan 2011 14:29:20 GMT
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How is the heart connected to the box?

Subject: Re: Heart breaks too heavy
Posted by [dizingof](#) on Wed, 12 Jan 2011 14:32:21 GMT
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It doesn't.

Subject: Re: Heart breaks too heavy
Posted by [aeron203](#) on Wed, 12 Jan 2011 14:39:54 GMT
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The shape you've created is challenging to create because there is no easy way to support the heart. Normally, odd shapes are supported by a fill powder that has fairly large grains. When there are objects in the way (the cage) the grains cannot support the structure well. Because of the particular shape, the heart is unable to rest flat and support itself. If they try to support it by the loop, the loop will break because of the mass of the heart. I have a similar problem when I use the epoxy dips because, if I don't remove the part very slowly, there is so much added weight from the epoxy that has not dripped off yet, that whatever part I am holding it by simply breaks off.

To make you model printable, enlarge the heart to connect with the cage, and ensure that the point of the heart (slightly flattened) is exactly even with the bottom of the cage. I know you wanted the heart to be floating, but having free-floating objects causes all sorts of problems with this process. It is possible on larger parts, but when you are talking about tiny things like this it becomes a puzzle that take incredible amounts of labor to solve.

The problems can be avoided by careful design.

Subject: Re: Heart breaks too heavy
Posted by [dizingof](#) on Wed, 12 Jan 2011 14:52:19 GMT
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I'm not entirely sure you are correct as to the large grain support ...

- i saw the video for stainless steel printing - its much like SLS only a printer head replaces the laser and binds the very thin steel powder with some kind of adhesive droplets until it's cooked in the oven - the particles that do not get adhesive are the support.

Anyway, just got a reply from CS - i should shrink the heart... its too heavy.

Subject: Re: Heart breaks too heavy
Posted by [Youknowwho4eva](#) on Wed, 12 Jan 2011 14:55:18 GMT
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I just watched the video just now. It's printed with an adhesive, then placed in a box and surrounded with the large grain support and bronze and baked. Also I have seen evidence of a sprue on all of my stainless prints.

Subject: Re: Heart breaks too heavy
Posted by [aeron203](#) on Wed, 12 Jan 2011 15:12:21 GMT
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You're right that in the printing stage the nearby build material is the support as in SLS. Mike is right that I was referring to the bronze infiltration stage.

Imagine welding a tiny bar onto each piece in a multi-part design and placing it so that it doesn't move and so the bar is extending into a tiny pile of powder. This whole setup has to remain perfectly still as you pour another powder on top of it. Now imagine there are dozens of these delicate little setups all in a box next to each other. If the parts move and touch before cooling they are bonded together and you have to do it again. The thermal cycles takes something like two days to complete. This partly explains why these mini-puzzles are no fun for the technicians.

<http://www.youtube.com/watch?v=TnjT1AloSNw>

Subject: Re: Heart breaks too heavy
Posted by [dizingof](#) on Wed, 12 Jan 2011 15:21:56 GMT
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Time to buy Direct Metal Laser Sintering printer... or two !

<http://www.youtube.com/watch?v=88BPmL8cGAo>

Subject: Re: Heart breaks too heavy
Posted by [aeron203](#) on Wed, 12 Jan 2011 15:35:40 GMT
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DMLS is pretty cool I have to say. Sometimes it is a better solution, but for some reason they have to print on a "raft" of support material like an FDM machine. That support creates a whole new set of design rules, and the labor to remove it is very expensive. The current process can do it just as well but the cost for all the labor would end up the same, much more than \$10/cc for tiny parts.

I don't know why DMLS needs supports and the current process doesn't. It may be that the melting pulls in some material from the edges and stops the powder from supporting.

Subject: Re: Heart breaks too heavy
Posted by [GlenG](#) on Thu, 13 Jan 2011 15:53:44 GMT
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Ok guy's,

Here are some clarifications on these topics. The ProMetal process does not require "rafting" for support during the print cycle because this is a cold process and the chemical binders are fast setting and extremely stable. In the SLS process the laser beam actually melts and fuses each build layer. This heat intensive process causes a lot of shrinkage in the material so additional support systems (rafts) are required to hold tolerances. It is also one of the reasons that SLS parts are typically 10x more expensive than ProMetal.

To accommodate the infiltration phase, every part has a "stilt" (sprue) added on to the design. This is done via software, prior to printing and is removed after the furnace run. The stilt acts like a wick/conduit to transfer a pre-measured volume of bronze into the printed stainless matrix.

Producing parts with free floating elements is a tricky business and personally, I am amazed that it works at ALL! There are several methods used to accomplish it. On large pieces, segments are separated by a temporary barrier material before going into the furnace. This barrier allows the separate elements to infiltrate with bronze through one central stilt, but at the same time prevents everything from fusing into a solid mass (most of the time). On small objects, like the caged heart, it is not practical and sometimes impossible to insert barrier materials. In these cases parts are simply allowed allowed to touch (no barrier). Under ideal conditions, complete infiltration will occur without permanently fusing everything together. If, the contacting surface patch is tiny, this bond can be broken free, and you will have your floating parts. Sometimes all it takes is gentle prying. Other times it takes a sharp rap with a hammer. If the contact patch is too broad and/or the surrounding elements are structurally inadequate, disaster can occur when trying to break this bond. I suspect this is the problem with Zings design.

Advice: Design the "heart" so it has something akin to a knife edge and beef up the cage. Be clever and do everything you can to reduce the contact patch of the separate elements. Hopefully this will cure your broken heart (sorry I just had to say that).

-G

Subject: Re: Heart breaks too heavy
Posted by [dizingof](#) on Thu, 13 Jan 2011 16:01:26 GMT
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Great post G - as always.

I was told by CS just to shrink the heart part a bit to resolve the issue.

Subject: Re: Heart breaks too heavy
Posted by [GlenG](#) on Thu, 13 Jan 2011 16:37:49 GMT
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Just not so small it will fall out of the cage. Good luck bro.

Subject: Re: Heart breaks too heavy
Posted by [dizingof](#) on Thu, 13 Jan 2011 16:42:28 GMT
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Of course, i was talking about it's thickness. thanks.
