Subject: Hardening steel
Posted by Maschinenhauer on Thu, 17 May 2012 10:01:44 GMT
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Hi,

I received my first order and was planning to harden it to about 55 HRC. I had someone analyze the material and this it what it mainly contains:

Cu: 43,5 %
Fe: 42 %
Cr: 10 %
Sn: 4 %

I don't know how much carbon it contains but I was told that Carbon is added to the percentage of iron or the highest overall, but that doesn't matter in this case. Right now I have already 27 HRC but that's not enough. I know that Shapeways products are supposed to be for decorative purposes, but if someone knows how to harden an alloy with that much copper I'd be thankful.

What I really liked was the fact that it is easy to turn, producing very short chips! The outer surface looks like a sintered product but the inside is not porous.

One thing I noticed on the website was that the hardness is supposed to be 26-30 HRC and the safety datasheet says that it is 20-25 HRC. Since I measured 27 I suppose the website is more up to date.

I was sure that I read on this website that this steel can be hardened to 55-60 HRC but maybe that was 420 SS without bronze

Thanks

Sebastian

Subject: Re: Hardening steel
Posted by stannum on Thu, 17 May 2012 23:29:26 GMT
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Shapeways "SS" is not an alloy with copper, it's a composite, a initial structure of 420 steel that later gets infused with bronze. Like putting a lot of small rocks in a box and then filling the air gaps in it with very fluid cement. A more proper name would be Steel Bronze Composite.

Subject: Re: Hardening steel
Posted by GlenG on Sat, 19 May 2012 16:09:56 GMT
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Sebastian,
Stannum is correct. The SS component is alloy 420 which is heat treatable. He is also correct that printed parts are a true composite with the SS making up about 60% of the volume.

Recently, the furnace profiles for the sintering/infiltrating process of printed parts was changed to include an annealing phase. So parts produced over the last 6-8 months are actually somewhat softer and much less brittle than those previously produced. This is generally advantageous for most customers.

Because this printed composite is somewhat of a metallurgical oddity it wil take some experimentaion on your part before a reliable hardening profile can be established. I can tell you that these printed parts are thermally processed in a controlled atmosphere furnace. No experiments have been done for hot quenching parts. So the relative hardness of processed parts relies on the heating/cooling cycle within the furnace. I do know that 420 stainless is subject to hardening simply by air cooling. But again, no experiments have been done to determine the effects of doing this.

Good luck with this Sebastian, we would love to hear what you can come up with.
-G

Subject: Re: Hardening steel
Posted by Maschinenhauer on Sat, 19 May 2012 18:29:45 GMT
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I will try inductive hardening and maybe nickel coating, but first I have to check if that is an option at all. I'll probably get that done within the next 2-4 weeks.

Subject: Re: Hardening steel
Posted by GlenG on Sat, 19 May 2012 18:49:54 GMT
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The nickel coating done for SW is by the electroless process, it's a very thin coating.

Subject: Re: Hardening steel

Posted by Maschinenhauer on Sat, 19 May 2012 19:53:26 GMT
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Sorry I don't know what you want to tell me exactly. I wanted to say that I will use nickel coating in case that hardening the material itself won't work. Nickel coating increases wear resistance which is what I need. I don't need to harden the entire material since my model is already strong enough except for certain areas which I cannot increase in size.