

Bubbles and Gel Candles

A project inspired by gel candle maker Deb Puerini

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I. INTRODUCTION

As I've mentioned before, I regularly receive a variety of questions and requests from people who hear about this publication. The ones from the technical community are generally well reasoned. Some are obnoxious ("I'm a student at XYZ College and have a paper due tomorrow on vacuum gauges, please send me all the information you have..."). Then there are the ones from confused English majors who confuse vacuum bell jars with something written by Sylvia Plath and then accuse me of plagiarism. And then there was the "farmer" who wanted to know how to freeze dry 2 lbs. of dirt (on second thought, maybe he was trying to preserve anthrax spores?).

A short while ago I got an email message from Deb Puerini, a dedicated gel candle maker who lives in Rhode Island. She wrote:

"I just stumbled upon your site from a Google search. I am a gel candle maker and recently heard about making gel candles bubble-free by (and I quote):

'....that her Dad, an engineer, had built her some type of contraption that has a vacuum pump or something to cause the bubbles be under a vacuum pressure, and when they were poured they had no bubbles. I think he should market the contraption instead of selling the candles.'

Do you have a clue as to what this "contraption" might be? I remember in high school we had a huge glass jar (like the 5 gal water bottles) and the teacher put marshmallows in it and closed the top. It had a vacuum pump or something and the marshmallows got huge. Do you know what I'm talking about? Well if you could let me know if a thing like that could be made, I would be ever grateful if you could build such a thing to help us poor gel candlemakers who are sick of bubbles in certain candles!"

From this it was obvious that she was describing a vacuum deairing process but what the heck is a gel candle? As I quickly found out, gel candles, rather than using conventional paraffin wax, use a clear, proprietary mix of mineral oil and a polymer to which are added dyes and scents.



Figure 1 - Gel Candle (Birdbath). Photo courtesy of Deb Puerini, used with permission.

II. GEL CANDLE BASICS

After a bit of correspondence with Deb I learned that these candles are made by melting the gel, mixing in the various additives and then pouring the gel into a container with, at the minimum, a wick. Because of the number of degrees of freedom that one has with this clear gel, the candle maker will usually add a variety of other items. The photo of Figure 1 shows a very ornate gel candle that has been made to look like a bird bath, complete with glass birds and a butterfly arranged on the lip. Frequently the candle maker will also insert objects into the gel. Because the clarity of the gel is important in some pieces, bubbles are something that the candle maker tries to avoid. The traditional way of doing this is to keep the gel hot for an extended period, permitting at least some of the bubbles to rise to the surface and break. Small bubbles and bubbles that have adhered to the immersed objects are the hardest to remove.

One of the largest manufacturers of this gel material is Pennzoil's Penreco Division (4401 Park Ave., Dickenson, TX 77539). Their gel candle product is called VersageI™ C. The product bulletin describes the generic candle making process as follows: 1) melting the raw gel

at a temperature of about 100 °C and mixing in the additives, 2) pouring at about 90 °C and 3) letting the candle set in an oven at about 65 °C to remove bubbles. Hope is an important part of the process.

III. A SIMPLE PROCESS

I figured that while deairing is a common and simple process (put the material under vacuum, pump down to enlarge, dislodge and burst the bubbles, and then let back up to atmosphere) there were some additional challenges here in terms of the gel nature of the material and having to complete the process before everything turns gooey again. So, I asked Deb for some sample candles with bubbles. These arrived within a few days.

My first attempt consisted of remelting the candles in the kitchen oven (boy did our house smell good), quickly transferring the candle to an improvised vacuum chamber and then pumping with a small rotary pump. Gauging was a simple Bourdon dial gauge, 0-30 inches Hg, atmosphere referenced.

Disaster. There was obviously some volatile component in the gel mix. The material bubbled out of control and splattered all over the vessel. (Deb informed me that bits of splattered gel are called *gel boogers* and that quite accurately describes the texture of this stuff.) On the plus side, the material (about half of the original amount) that remained in the candle container was bubble free.

The next attempt was more controlled. I added a pressure control feature and dropped the pressure in quick stages to about 20 inches Hg where the bubbles got noticeably large and mobile, and then to 28 where they moved upward quickly and broke upon reaching the surface. In the range of 29 inches the material looked like some volatile components were coming out. So, 28 inHg looked like a good lower pressure limit.

The final apparatus is depicted in Figure 2. The bell jar was an old pyrex jar that I got from Fisher Scientific many years ago. Inside dimensions are about 5.5" diameter and 8" tall. To keep any boogers from getting into the plumbing I put a PVC pipe cap with a small hole drilled in the side over the outlet port as a platform/baffle. The pipe nipple attached to the mounting flange is plugged with epoxy. Pressure is controlled by pinching the neoprene tubing with the pinchclamp. The pump, not shown, is a small Robinair 1.2 cfm pump, model 15200.

Figuring I'd done all I could, I packed everything up and sent it to Deb, the gel candle expert.

IV. FINAL RESULTS

Realizing that I was dealing with someone who'd never operated a vacuum pump, I waited in suspense. Two days after receiving the system Deb reported that she'd not only set it up, she had tortured a marshmallow chick,

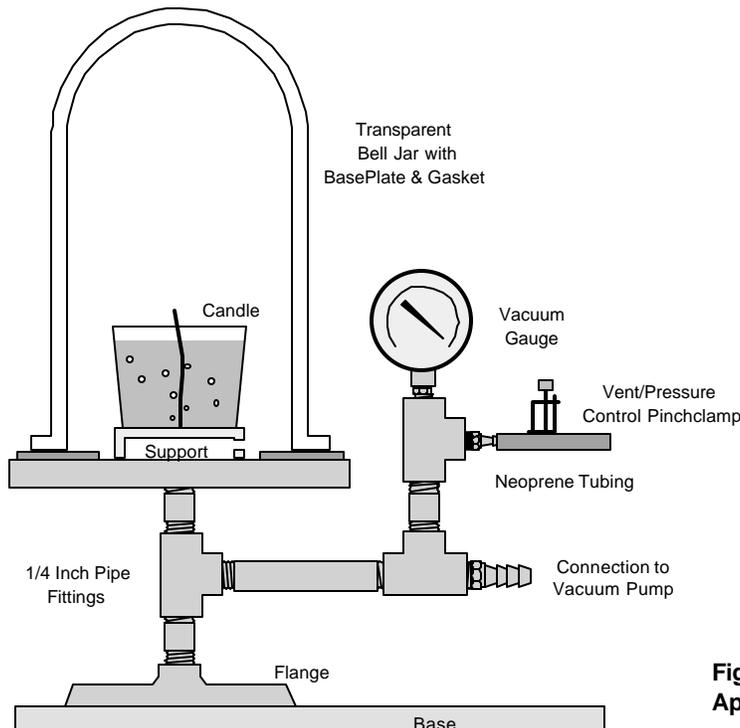


Figure 2 - Gel Candle Deairing Apparatus

thereby replicating the classic vacuum experiment. The next day she reported results:

“Well I think I’ve got the system down.....the trick is to color and scent the gel, stir it up well, then stick it in the vacuum at 28 inches for at least 1 minute (still very hot) and then pour into the designated container. The proof of the pudding is waiting overnight to see what has happened during the cooling off period....well I must say this has *gotta* be the answer!!! I poured one last night with epsom salt at the base (for snow) and put a glass penguin in...this morning there is NOT ONE BUBBLE to be seen!!! Now the epsom salt usually presents a big bubbling problem, but wow!!! clear clear clear!!! I am sooooo excited about this!!! I poured another one just a few minutes ago with glass flowers and glass marbles in the bottom and even put glitter in....wow!

I have “run the controls” in all ways and methods, no matter how high the temperature of the gel is you will get some bubbles then you have to reheat again to get the bubbles out. Even then it always varies which is the most aggravating part. But with the vacuum method, it gets out so many bubbles as long as I have colored and scented the gel to my satisfaction, the bubbles will not come back. I’m sure if I stirred again after vacuuming they would come back. I did the most important test, silk

flowers with gel, and put the container in the vacuum and it’s really something. Bubbled like all hell but then is still clear as anything!”

V. CONCLUSION

I have to say this was a fun project since I not only got someone introduced to using vacuum to practical ends but also I learned about the wonderful technology of gel candles. (Now, can this gel stuff be used to pot high voltage electrical assemblies?)

For anyone that is interested in Deb’s excellent work, please visit her extensive Web photograph album at <http://www.netSnapShot.com/pcw/B?KEY=41&ACCOUNT=684>. She can also be reached by email at lovesalsa@cox.net.

FURTHER READING

An excellent resource for gel candle making is on the Web at:

<http://www.howtomakegelcandles.com/index.asp>



Figure 3 - “Fishbowl” A Deaired Gel Candle by Deb Puerini