



heat LESSONS LEARNED treating BY A FACETER tourmaline

BY LISA ELSER

WHEN YOU BUY TOURMALINE IN PARCELS, you get the good mixed with the not so good. After I'd started faceting seriously and buying a lot of rough, I'd find lovely large stones in my rough box that were just too dark. I'd learned about heating tourmaline from my teachers, but I didn't own a furnace and had never tried it myself. Then my husband and I started our business. Now making those dark stones into something saleable took on new importance. I invested in a programmable burnout oven and began learning through trial and error.

One tourmaline of mine went in front of a client three times without getting so much as a glance. After I'd heated the stone, he bought it on the next visit, saying he'd never seen a cut like that before. He'd seen the cut, of course, but not in that new color!

Although I'm a gemologist with a small home lab, I don't have complex spectrography at my disposal. Other than a few of you (you know who you are, lucky dogs), you probably don't either. Anything I did in the way of heating had to be based on tools around the house and a method that most faceters could also handle.

It's tempting to say there are recipes for heating stones, but really, that's misleading. If you follow a recipe you'll get a result — and that's *not* how gem heating works. Heat treating is more of an approach, where you can determine what works for specific stones or groups of stones.

Here I'll describe what I do in my own work, and share some of my experiments, both successes and some stunning failures, to help you determine if and how to do your own heat treatment. All of the tourmaline described here is Nigerian, but the approach to heating should work with stones of any origin.

WHEN TO HEAT

Tanzanites can darken with heat while tourmalines and zircons can lighten. Any of them can also crack, craze, or turn some unexpected or undesirable color. How can you determine who needs a bit of a boost and who needs to be left alone?

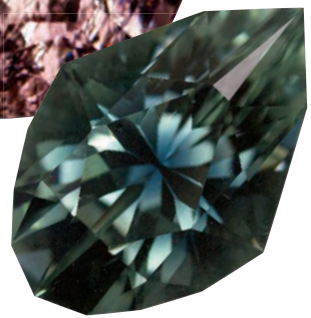
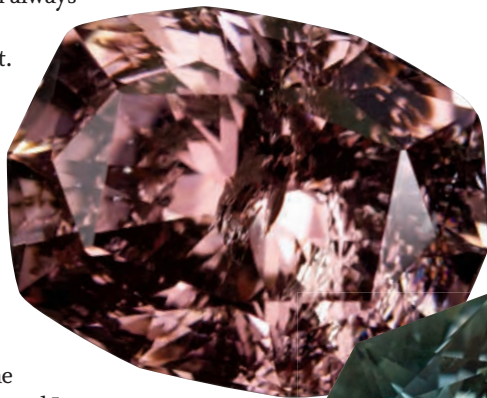
That is the question. Some gems are “universally” pretty: whether or not someone likes the stone, 99 percent of people will agree that

it is a pretty color. For most gems, though, it's impossible to tell whether someone will fall in love with them. I'm always surprised to see what sells and what doesn't.

If you're faceting for yourself or your loved ones, then the choice is easy. If you don't like the color, you can either give it to someone who does, or try heating.

I sell my work to jewelers, so a new stone goes into the collection and I watch the reactions. A stone that gets no attention from several clients isn't likely to sell and is a good candidate for heating. If the stone is damaged in the process, it's worth exactly as much as a stone that no one buys.

Overly dark stones seem to be invisible. Tanzanites that are too pale get ignored. One tourmaline of mine went in front of a client three times without getting so much as a glance. After I'd heated the stone, he bought it on the next visit, saying he'd never seen a cut like that before. He'd seen the cut, of course, but not in that new color!



These gems and their treatments are detailed on the following pages.



Figures 1a and 1b

10.6 ct. tourmaline before and after heating. Notice the inclusions in the lighter stone. They were not visible before heating.

WHEN NOT TO HEAT

What you do with your electricity is your business, but I've run up my bill a few times and have surrendered to the evidence.

- Chrome tourmaline does not lighten with heat. Recutting dark ones smaller can lighten them, though.
- Black C axis tourmaline may lighten on the A/B but the C remains black. Give it to children to play with and cut something else that will make you happy.
- Inclusions will get worse. Inclusions you never saw may appear. If the stone isn't clean under magnification, be aware that it may be destroyed in heating.

Figures 1a and 1b are a Nigerian rubellite, 10.6 carats. Although the before photo looks great, the stone was very dark in reality and rode in my inventory for months without anyone looking at it. When I finally did heat it, not only did it go much lighter than I'd hoped, but some small inclusions near the culet blossomed. The stone will be sawn and cut into pale pink earrings. Since it wasn't going to sell anyway, it isn't much of a loss, although it hurt to see the results.

SAMPLE, TEST, HEAT

Gemstones have a mystical appeal, but creating them from rough involves planning, practice, and a methodical approach. That's true for cutting, but even more so for heating. For me, getting good results from heating involves three things: sampling, testing, and final heating.

Sampling. Tourmaline color is complex. Although it's possible to predict what might

happen from one stone to the next in a parcel from the same mine, it's not 100% accurate. Some general rules of thumb that seem to work for me are:

- When you buy a parcel, check the stones to see how similar they seem to be. You can use your eye to check for things like dark cores or a dark C axis, color ranges, and any matrix. You can also use a spectroscope and compare spectra across the stones.
- If the stones are similar or can be divided into groups of similar stones, select the least likely faceting candidate in the group(s).
- If you can saw it into chunks, do so.

Now you've got a sample of a few stones to test. You'll want to heat them until you get the result you want, record your "recipe" in your notes, and put a copy in with the parcel. You have a better chance of getting the right result with your cut stones if you've been able to do some advance testing.

If you have only one stone, can you sacrifice an end? A slightly smaller, pretty stone is better than a slightly larger, dull one. Sawing off an end lets you test your temperature, and you're working on the exact stone you'll later heat.

When buying a single stone, ask your rough dealer if he or she has an included or small one from the parcel. You might be able to buy a sample stone cheaply.

Testing. For these tests, I used three sets of tourmaline, all of it Nigerian. The first was slightly yellowish green. It's not bad to cut, but it could be brighter. The second was some dark rubellite, its typical pink color mixed with purple and brown tones. This material has a



Figure 2a. Set 1
Green tourmaline with yellow cast

dark core, and anything over two carats cut is too dark for my taste. The third set consisted of stones that were olive green, a color that I find unpleasant.

I sawed the stones into uniform chunks, organized them into six bags, and proceeded to heat them using regular temperature increases. Figures 2a, 2b, and 2c show material from the three sets.

For the sake of simplicity, all the heat programs ramped up at 100° C per hour and cooled naturally in the closed oven. This is what I do for cut stones to minimize thermal shock, and with the programmable oven, it's easy.

All stones were held at the desired temperature for 90 minutes.



Figure 2b. Set 2
Dark core rubellites
(deep pink tourmaline)

TEST HEATING

TEMP	SET 1 Green	SET 2 Rubellite/ deep pink	SET 3 Olive
450° C	No change	No change	No change
500° C (w/ or w/o prior heating)	Lost yellow cast	Dark core lightened	No change
550° C	Slightly lighter	Bright pink	Slightly lighter, still olive
600° C	No further lighting	Light pink	No further lightening
650° C	Slightly lighter	White	No further lightening

Figure 3.
Results of test heating on the three samples.



Figure 2c. Set 3
Olive tourmalines



Figure 4a
450° C

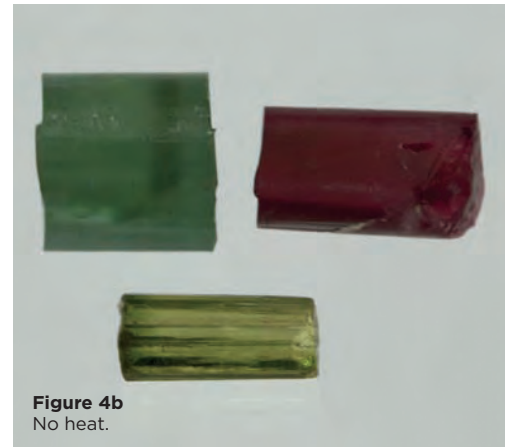


Figure 4b
No heat.

450° C TREATMENT

The first pass (Figure 4a) showed almost no change. The C axis on the rubellite was still dark, although the outer skin had lightened slightly. Both greens were still quite dark. I used the lightest of the greens in the No Heat sample (Figure 4b).

500° C TREATMENT

One of my own big questions was “does intermediate heating matter?” Usually I’m increasing the heat on a stone until the color is right. Could I just go directly to the higher temperature next time, or did those additional steps matter?

I had heated a second set of stones in the 450° C pass, and included those into the 500° C pass.

Although it is subtle and difficult to see in Figures 5a and 5b, sets 1 (green) and 2 (pink/rubellite) are lighter after treatment than before it. The green lost some of its yellow and became a pleasanter color. The rubellite lost its brown and would cut much nicer stones.

Note that there is no difference between the set in Figure 5a, first heated at 500° C, and the set in Figure 5b, which was heated to 400° C and then to 500° C. This means I can go straight to 500° C if that’s the effect desired.

The biggest difference in the stones was that at 500° C, the dark core in the rubellite is gone (Figures 6a and 6b). It’s a rich saturated pink and would cut a gorgeous stone.

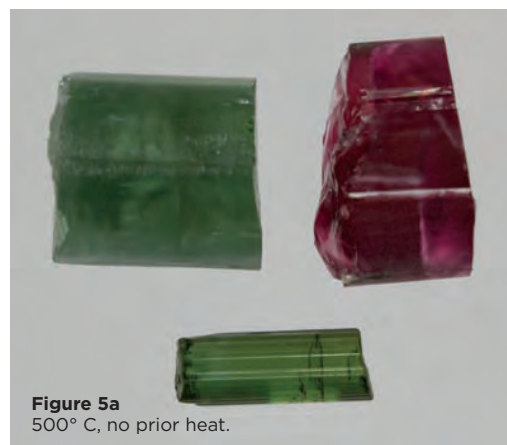


Figure 5a
500° C, no prior heat.



Figure 5b
500° C after 400° C



Figure 6a
The rubellite at 450° C. The core is very dark.



Figure 6b
At 500° C, the rubellite core is lightened.

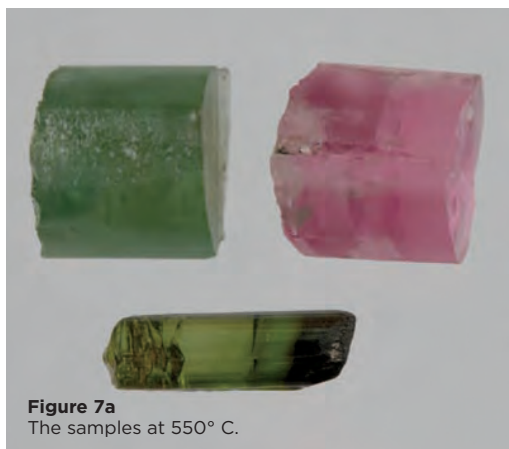


Figure 7a
The samples at 550° C.

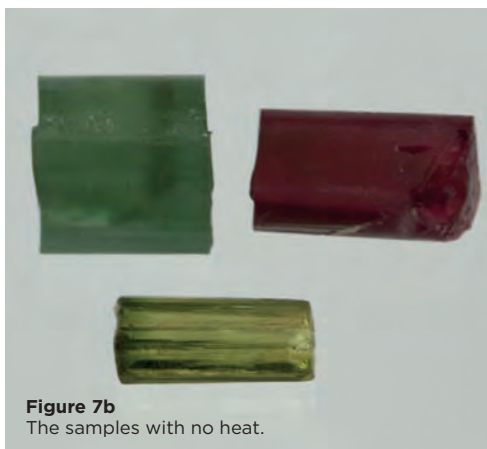


Figure 7b
The samples with no heat.

550° C TREATMENT

The samples in Figure 7a were treated directly to 550° C. There was noticeable lightening in all three samples. The rubellite is now a pink, but too light to be properly called rubellite. It's a pretty color, though. Both greens ("green" and "olive") have lightened, but the olive stone from Set 3 retained the olive tone.

ABOVE 550° C

At 600° C, the rubellite had lost most of its color, while the two greens were holding steady. As I continued to take the heat up, the stones began to look burnt, and by 700° C were brittle and not useable. The greens were still green, however.

how to heat stones

In order to heat your own stones, you'll need:

- An oven capable of reaching at least 600° C (1100 Fahrenheit)
- A crucible or other heat-safe container
- Casting investment or a polishing oxide to fill the crucible

I strongly recommend a programmable oven. They are expensive, but the ability to set your parameters and walk away will save you time and energy and prevent costly mistakes.

The oven should also be well insulated. It doesn't cost much to run a good oven, but a badly insulated oven can use plenty of energy, as well as filling your house with unwanted heat. It can also potentially allow overly rapid cooling and cause thermal shock.

1. *Examine the cut gem with the best magnification you have. Use a darkfield loupe if you don't have a microscope. Inclusions, cracks, or feathers can get worse during heating.*
2. *Clean the gem well with acetone or alcohol. Give it a good rub with a microfiber cloth to remove any residual fluid.*
3. *Fill the container with casting investment or a polishing oxide. I use investment.*
4. *Press the gem gently into the investment, then cover it over. You don't need a big container, but the gem should be covered on all sides. You can place more than one stone in a container as long as the stones have some room between them and do not touch.*
5. *Ramp the heat up slowly. I use 100° C per hour. This lets the stone heat gradually and minimizes the risk of shock.*
6. *When the oven has reached the desired temperature, hold it for your "soak" time. Try starting with 90 minutes if you don't have other information.*
7. *After the "soak" time is up, shut off the oven and keep the door closed. My oven cools naturally at about 100° C per hour, but if yours cools faster, you may want to ramp down the heat slowly.*
8. *DO NOT OPEN THE OVEN until you can take the container out with your hands.*

For my usual rubellite treatment or 500° C for 90 minutes, this process takes over 12 hours. With the programmable oven, I start it in the evening and check on the results in the morning.

With systematic sampling and testing, you are far more likely to have good results and prettier gems.



Figures 8a and 8b
A peach tourmaline lightened to a sage green with heat.

WHAT I LEARNED

This was by no means a comprehensive or a scientific study, but it did clarify for me some things I'd learned over time.

One of the first stones I ever heated was a peachy/pink tourmaline that heated to sage green. I was utterly baffled, but now I know that pink heats out first, and any green or blue undertones stay behind.

Now that I realize pink heats out easily and greens and blues are more durable, I've been able to use it to my advantage.

Another stone started out as a blue and pink tourmaline. After cutting, it was a muddy, unattractive mix of the two. With only one of these nodules and no way to sample it, I relied on my experience with other Nigerian tourmalines. After heating at 550° C, the pink disappeared, leaving a very pretty greenish blue (Figures 9a and 9b).

These are only my results, with my tourmalines. The important thing when heating your own stones is to follow a process and document your attempts and results. As I saw here, two similar sets of Nigerian green tourmalines behaved very differently. One lost its yellow cast and heated to a better color (Figures 9a and 9b). The other never got any prettier, although it did get marginally lighter. With systematic sampling and testing, you are far more likely to have good results and prettier gems.



Figures 9a and 9b
Pink on the A/B axis heated out, leaving the blue/green intact.

ACKNOWLEDGEMENTS

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