

# SHRINKAGE AND EXPANSION OF BAMBOO

(Presented by Ron Grantham and Don Andersen at Corbett Lake Rod Builders' Gathering, May 2002)

Did you ever consider how each step in the process of building a bamboo rod can affect the next step? Take, for example, the relationship between heat-treating and planing to final dimension, or vice-versa. Is it better to plane to final dimension *after* heat-treating, as suggested in the Carmichael/Garrison book, or should one plane to final dimension *before* heat-treating?

First of all, we must consider the moisture content of bamboo. Water is held in bamboo in two ways: *free water*, which is held in the cell cavities, and *bound water*, which is held in the cell walls themselves. During storage, bamboo air-dries and loses free water until the moisture content is about 15 percent. When heat-treated during rod construction the bamboo will shrink as the remaining water is driven out, but within a week the bamboo will regain some moisture from the surrounding air's *relative humidity*. Even after heat-treating, bamboo cells continue to lose and gain moisture, with corresponding dimensional changes, as the bamboo reaches equilibrium between the amount of bound water and the surrounding air's relative humidity. The rate and speed of moisture exchange depends on the relative humidity in the air, and the varnish, or moisture-proofing, that is applied to the outer surface of the rod.

To prove a theory, I selected two triangulated strips that had been in my shop for a year or more. Each strip was marked and carefully measured at five random locations, and the dimensions were recorded. The strips were then heat-treated for 20 minutes at 350°F. After removing them from the oven, I waited a minute or two until they cooled enough for handling, then carefully measured them and again recorded the data. The following day I repeated the measurements, and did so daily for a week, then weekly for a month.

To assist in the test, two friends, **Don Andersen** and **Gerry Arbeider**, also heat-treated and measured some strips. Arbeider did the same test as me, but he did it on the butt and tip strips of a rod he was currently working on. Andersen's testing was more extensive in that he also weighed his strips to help determine the percentage of moisture loss and gain. (He also measured the rod after gluing to determine further dimensional changes, but that is another story.)

Basically, our findings were:

- A change in the amount of moisture in bamboo is directly related to a change in dimension.
- The amount of shrinkage depends on the size of the strip, i.e. the larger the strip, the larger the amount of shrinkage.
- As a percentage, the shrinkage was small. Nonetheless, the lost dimension is enough to influence the size of flyline required.
- After a week, all test strips had regained about half the lost dimension, but all were still smaller than the pre-heat-treated dimensions.

Conclusions reached were:

- If planing to final dimension *before* heat-treating, the finished rod can end up as much as .004" undersize (.002" for each half-diameter) due to shrinkage.
- If planing to final dimension *immediately after* heat-treating, the finished rod can end up as much as .004" oversize (.002" for each half-diameter) due to expansion by absorption of moisture from the surrounding air's relative humidity.
- The most accurate method would be to heat-treat the slightly oversize strips, then leave them for about a week before planing to final dimension.

Because a change of .005” in a rod’s diameter can be one full line size, an error of .002” in the half-diameter is definitely noticeable.

If you make your own tapers, the foregoing is of little consequence as long as you are consistent in your methods. The problems arise when tapers are exchanged between builders; then, the original sequence of construction methods may have to be considered. But on the other hand, if you have a well-designed taper, the copier will still end up with a fine rod, perhaps not exactly the same line size (which is still dependent on the make and model of fly line, the user’s casting ability, and the preference to rod-loading during casting.)

Below are graphs which indicate the shrinkage and expansion that occurred during three different tests. The full documentation is available by emailing me at [flyfishr@istar.ca](mailto:flyfishr@istar.ca). The documentation for Don Andersen’s tests are available from him at [dmanders@telusplanet.net](mailto:dmanders@telusplanet.net).

