

Bologna bottles are thick-walled glass bottles that have their outside hardened and their inside very highly strained.<sup>†</sup> The outside of the bottle can be used to pound a nail into a piece of wood, as shown in *Figure 1*. However, slight scratching of the inside surface caused by pouring carborundum crystals into the bottle causes the bottle to shatter.



*Figure 1*

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<sup>†</sup> Freier and Anderson, *A Demonstration Handbook for Physics*, Demonstration MA-6, Bologna Bottle.

We think of glass as a fragile material, but just how fragile it is depends on how it is treated during manufacture.

This glass bottle was blown out of ordinary glass then cooled rapidly. The rapid cooling leaves the glass with large amounts of internal strain. The outside of the bottle was then annealed by reheating and cooling it slowly to remove the strain.

The outer layer of the bottle is very tough, and can even be used to drive a nail.

The inner surface of the bottle still has a lot of internal strain; so much that when we scratch the inner surface by dropping sharp pieces of carborundum into the bottle...

the released strain shatters the bottle from the inside.

***Equipment***

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1. Safety goggles.
2. Bologna bottle (commercially available).
3. Block of wood.
4. Nail.
5. Gloves.
6. Supply of carborundum.