

## **Investigation 4: Acoustic Properties of Nitinol**

### Supplies

NiTi rods used in Investigation 3 above

Hot water (at least 80 °C)

Meter stick (optional)

tongs

### Teacher Notes

In this investigation, students have a chance to examine the different acoustic properties of Nitinol in its two phases. Students will observe how these acoustic properties change as Nitinol cools. When dropped, martensite tends to make a “thud” while austenite makes ringing sound. It is not surprising that the two NiTi phases also exhibit a different “acoustic signature” as well as other physical properties. The propagation of sound is affected by a number of factors but most certainly depends upon structure. The uniform structure of austenite allows sound waves to travel through it readily. In martensite, on the other hand, the boundaries between regions with different orientations of the less symmetric monoclinic structure act to reduce the vibrations and muffle the sound. The net result is a noticeable “ringing” sound when the austenite rod is dropped, compared to a dull “thud” for the martensite.

Students will hold the martensite sample in the hot water for a few seconds. They should notice that it becomes rigid (transforms to the austenite phase). They will quickly take it out of the hot water, drop it, listen to the sound produced, and continue to pick it up and drop it until there is no more change in sound. Students should observe that as the rod cools, it goes from the austenite phase to the martensite phase and consequently the sound goes from ringing to thudding.