Influence of specimen dimensions on tensile behavior of NiTi alloy

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Nitinol is a shape-memory alloy composed of nickel and titanium that can exist in three different states, each with unique properties and behaviors. The three states are martensite, superelastic austenite capable of transforming into stress-induced martensite, and stable austenite. The main variable that affects the presence of these states for given chemical composition of the alloy is the temperature.

The Young's modulus of the NiTi alloy is reported to range from 28 to 83 GPa, with higher values corresponding to superelastic austenite. Nevertheless, his Young's modulus is more closely aligned with the elastic properties of human bone than any other metallic material utilized in the field of biomedicine.

It is therefore of great importance to identify an appropriate phase composition in order to ensure the convenient superelastic properties and mechanical strength of plates or nails that can be used in traumatology or orthopedics. The mechanical properties of NiTi specimens are studied by the tensile testing that is usually conducted either up to specimens breaking or only to superelasticity region manifestation with subsequent unloading.

This work investigates the specimen dimension effect on the tensile behavior for NiTi alloy with the composition of 56.31 wt.% Ni and 43.69 wt.% Ti. The development of the curves at tensile testing of two different dimensions of NiTi was evaluated. The phase composition of the NiTi testing material was determined by XRD and DSC analysis.

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