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## ***Analysis of temperature changes of a Ti-based alloy Gum Metal under selected loadings in the context of its unconventional deformation mechanisms***

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Analysis of average temperature changes of Gum Metal with composition Ti–23Nb–0.7Ta–2Zr–1.2O (at.%) under tension and compression was realized. It was shown that temperature response of the alloy can indicate selected regimes of deformation (purely elastic, superelastic-like and plastic deformation). The rate of temperature change during loading was associated with various deformation mechanisms including this of superelastic-like deformation related to phase transformation hindered by oxygen content of Gum Metal (activity of nanodomains) [1]. This unusual deformation mechanism was found to be thermodynamically reversible (exothermic during loading and endothermic during unloading for both tension and compression) [2].

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### REFERENCES

1. T. Saito, T. Furuta, J.H. Hwang, S. Kuramoto, K. Nishino, N. Suzuki, R. Chen, A. Yamada, K. Ito, Y. Seno, T. Nonaka, H. Ikehata, N. Nagasako, C. Iwamoto, Y. Ikuhara, T. Sakuma Multifunctional Alloys Obtained via a Dislocation-Free Plastic Deformation Mechanism. *Science* 2003, 300, 464-467
2. E.A. Pieczyska, M. Maj, K. Golasiński, M. Staszczak, T. Furuta, S. Kuramoto Thermomechanical Studies of Yielding and Strain Localization Phenomena of Gum Metal under Tension. *Materials* 2018, 11, 1-13.