# Article information:

Low-hysteresis shape-memory ceramics designed by multimode modelling | Nature
[https://www.nature.com/articles/s41586-022-05210-1?utm\_source=xmol=affiliate=meta=DDCN\_1\_GL01\_metadata](https://www.nature.com/articles/s41586-022-05210-1?utm_source=xmol&utm_medium=affiliate&utm_content=meta&utm_campaign=DDCN_1_GL01_metadata)

# Article summary:

1. Martensitic transformations are a type of rapid, displacive phase transformation from one crystal structure to another and have engineering relevance for the emergence of shape-memory properties.

2. Researchers have recently realized that hysteresis can be engineered through subtle manipulations of the lattice parameters of the two phases involved in the transformation.

3. This paper outlines a methodology combining machine learning, computational thermodynamics and lattice engineering to predict shape-memory characteristics of new ZrO2-based compositions, resulting in a polycrystalline martensitic zirconia ceramic with record low thermal hysteresis.

# Article rating:

May be slightly imbalanced: The article presents the information in a generally reliable way, but there are minor points of consideration that could be explored further or claims that are not fully backed by appropriate evidence. Some perspectives may also be omitted, and you are encouraged to use the research topics section to explore the topic further.

# Article analysis:

The article is generally reliable and trustworthy, as it provides evidence for its claims and presents both sides of the argument equally. The authors provide detailed information on their methodology, which includes machine learning, computational thermodynamics and lattice engineering to predict shape-memory characteristics of new ZrO2-based compositions. They also provide evidence for their predictions by comparing model predictions with experimental data points. Furthermore, they present results from experiments conducted to validate their predictions, which show good agreement between measured values and model predictions.

The article does not appear to contain any biases or promotional content; however, there are some missing points of consideration that could be explored further. For example, while the authors discuss how different dopants affect Ms, λ2 and ΔV/V in binary systems (Fig 2), they do not discuss how these parameters may be affected when multiple dopants are combined in ternary or quaternary systems. Additionally, while they discuss how friction at low temperatures affects transformation hysteresis (6), they do not explore other factors that may influence this parameter such as grain size or microstructure.

In conclusion, this article is generally reliable and trustworthy; however, there are some missing points of consideration that could be explored further in future research.

# Topics for further research:

* Ternary and quaternary systems in shape-memory alloys
* Effect of grain size on transformation hysteresis
* Influence of microstructure on shape-memory characteristics
* Computational thermodynamics of shape-memory alloys
* Machine learning for predicting shape-memory properties
* Lattice engineering of ZrO2-based alloys

# Report location:

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