VIDEO ARTICLE

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A Highly Distorted Ultra-Elastic Chemically Complex Elinvar Alloy

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Abstract

The development of high performance ultra-elastic metals with superb strength, a large elastic strain limit and temperature insensitive elastic moduli (Elinvar effect) are important for a variety of industrial applications, from actuators, medical devices to high precision instruments. The elastic strain limit of bulk crystalline metals is usually less than ~1% due to dislocation easy gliding. On the other hand, shape memory alloys, including gum metals and strain glass alloys, may attain an elastic strain limit up to several percent, which, nevertheless, is due to pseudo-elasticity and accompanied by large energy dissipation. Recently, chemically complex alloys, such as "high entropy" alloys, have attracted tremendous research interest due to their promising properties. In this work, we report the discovery of a chemically complex alloy with a large atomic size misfit usually unaffordable in conventional alloys, which exhibits a high elastic strain limit (~2%) and an extremely low internal friction ($< 2\times10^{-4}$) at room temperature. More interestingly, this alloy exhibits an extraordinary Elinvar effect and maintains near constant elastic modulus between room temperature to 627ºC (900 K), which is unmatched by the existing alloys hitherto reported.

Biography

Yong Yang obtained his bachelor's degree from Peking University in 2001, MPhil from Hong Kong University of Science and Technology in 2003, and PhD from Princeton University in 2007. He is now affiliated with several departments at College of Engineering in City University of Hong Kong. His current research interest includes nanomechanics, design of advanced bulk alloys (e.g., bulk metallic glasses, high entropy alloys) and low dimensional alloys/ceramics (e.g., nanosheets, nanowires, nanoparticles), materials informatics, nano-manufacturing and additive manufacturing (e.g., binder jet 3D printing). His work has been published in multi-disciplinary and leading journals in materials, such as Nature, Nature Materials, Nature Communications, Science Advances, PNAS, Advanced Materials, Materials Today, Nano Letters and etc.

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