Versatile, high-speed, and efficient crystal actuation with photothermally resonated natural vibrations

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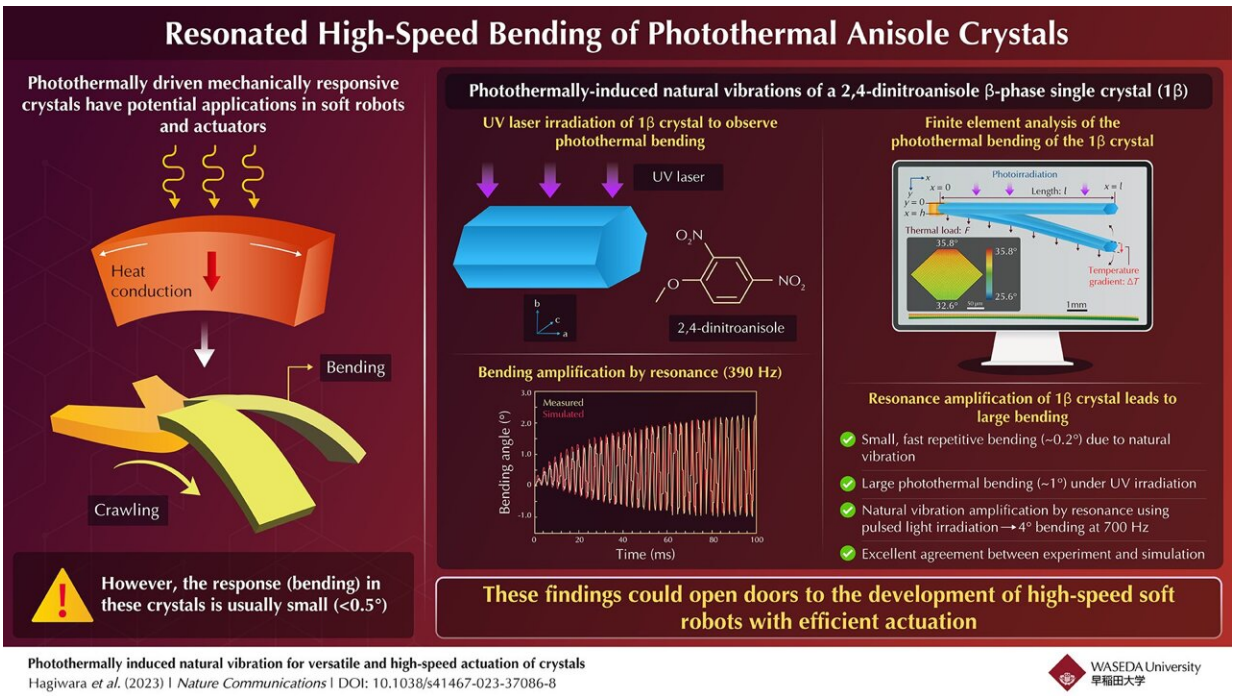

Researchers from Japan have demonstrated high-frequency and large resonated natural vibrations in anisole single crystals driven by pulsed UV radiation at the natural vibration frequency of the crystal. Their research has immense potential for advancing the field of soft robotics and versatile actuation technology. Credit: Dr. Hideko Koshima from Waseda University

Every material possesses a unique natural vibration frequency such that

when an external periodic force is applied to this material close to this frequency, the vibrations are greatly amplified. In the parlance of physics, this phenomenon is known as "resonance." Resonance is ubiquitous in our daily life, and, depending on the context, could be deemed desirable or undesirable.

For instance, musical instruments like the guitar relies on resonance for sound amplification. On the other hand, buildings and bridges are more likely to collapse under an earthquake if the ground vibration frequency matches their natural frequency.

Interestingly, natural vibration has not received much attention in material actuation, which relies on the action of mechanically responsive crystals. Versatile actuation technologies are highly desirable in the field of soft robotics. Although crystal actuation based on processes like photoisomerisation and phase transitions have been widely studied, these processes lack versatility since they require specific crystals to work.

One way to improve versatility is by employing photothermal crystals, which show bending due to light-induced heating. While promising for achieving high-speed actuation, the bending angle is usually small (