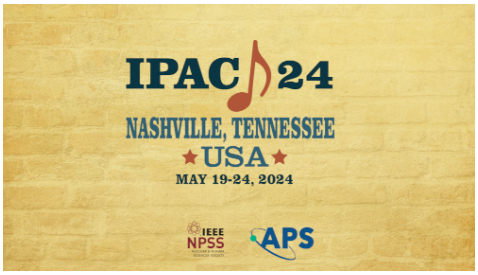


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# Thermoelastic response of Bragg crystals under MHz thermal loading

*Monday, 20 May 2024 16:00 (2 hours)*

An x-ray free-electron laser oscillator (XFELO) is a promising candidate for producing fully coherent x-rays beyond the fourth-generation light sources. An R&D XFELO experiment (ANL-SLAC-Spring-8 collaboration) to demonstrate the basic principles and measure the two-pass FEL gain is expected to be accomplished by 2024. Beyond this R&D experiment, an XFELO user facility will be eventually needed to produce stable x-ray pulses with saturated pulse energy at MHz repetition rate. However, one of the outstanding issues for realizing an MHz XFELO is the possible Bragg crystal degradation due to the high-repetition-rate thermal loading of the high-pulse-energy x-rays. The deposited energy by one x-ray pulse induces temperature gradients and elastic waves in the crystal, where the deformed crystal lattice impacts the Bragg performance for subsequent x-ray pulses. Here, we report on the numerical study of the crystal thermoelastic response under thermal loading of x-ray pulse trains. The long-term decoupled thermoelastic behavior of the crystal and the possible mitigation of the thermal loading such as crystal cryogenical cooling will be discussed.

## Footnotes

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