

## Suppressing NaI(Tl)–Quartz Adhesion with NH<sub>4</sub>I: Successful 3×3” Bridgman Growth

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Ultra-radiopure NaI(Tl) crystals are a key detector material for dark matter search experiments, where sealed synthesis and growth are commonly used to minimize the introduction of impurities. Although the Bridgman method using quartz ampoules is widely employed, strong adhesion between NaI(Tl) and silica has been a major challenge for decades. We addressed this issue by using ammonium iodide (NH<sub>4</sub>I), which generates HI in situ and suppresses the NaOH–SiO<sub>2</sub> reaction that forms adhesive sodium–silicate. Small test crystals were first grown to optimize the NH<sub>4</sub>I concentration and growth conditions needed to eliminate adhesion and bubble formation. Applying these optimized parameters, we successfully grew a crack-free, bubble-free 3×3-inch NaI(Tl) crystal. The crystal achieved  $27.2 \pm 1.5$  NPE/keV light yield,  $3.86 \pm 0.14$  % energy resolution (FWHM) at 59.5 keV (<sup>241</sup>Am) and an intrinsic alpha background from the <sup>210</sup>Pb decay chain of  $0.222 \pm 0.025$  mBq/kg, comparable to the best crystals reported by COSINE-100.

