Light weight silicon mirrors for space instrumentation

Each mirror is a monolithic structure from a single crystal of silicon.

The mirrors are light weighted after the optical surface is ground and polished.

Mirrors made during the initial phase of this work were typically 1/50 λ or better (RMS at 633 nm).
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Steps in Initial Process:

1: Form a blank from a single crystal silicon boule

2: Heat treat the blank at 1250 C to heal crystalline damage caused by the sawing and grinding used to form the blank

3: Form the optical surface by conventional grinding & polishing

4: Bond a protector disk to the optical surface using stacking wax

5: Light weight the mirror using ultrasonic machining to form an isogrid pattern

6: Remove the protector and heat treat again to heal crystalline damage caused by the light weighting process
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Figure before lightweighting

Figure after lightweighting, before heat treating

Figure after heat treating
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CIRS-Lite Cassegrain Primary

Rear View (model)

Front View (photo)
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TIRS Scene Mirror / Backside View
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TIRS Scene Mirror / Front View
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Cryogenic Test Facility

- Shutter (open)
- Shutter Control
- Mirror Baffle
- Dewar Window
- Mirror
- Cold Plate
- Test Dewar

NASA
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Measured Change RT vs 83K w/o Power = 0.001\(\lambda\)

Actual Power Change After Compensating for Dewar Window = 0.056 \(\lambda\) P-V, = \(\lambda/30\) RMS.
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Flat Mirror with Side Mounting Ferrules