

Rediscovering Makyoh

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Introduction

Makyoh, also known as “magic mirrors,” are an ancient Chinese art form that date back to the second century B.C.¹ When collimated light (such as the light from the sun) reflects from the bronze mirror onto a flat surface, the relief pattern on the back of the mirror is visible on the flat surface¹. This is because the surface of the mirror contains imperfections too small to be visible to the unaided human eye^{1,2,3}.

Objective

- Create a working reproduction of a Makyoh mirror.

Broader Impact

- Teaching Aids
- Forensic Serial Number Recovery
- Surface Mapping of Semiconductor Wafers
- Jewelry

Procedure

- Used alloy 220 bronze and 260 brass 0.040” thick
- Cut sheet into 3” square blanks (Figure 2)
- Formed metal using five .22 caliber blanks (Figure 3)
- Trimmed flashing
- Polished initially with 240, to 400 grit silicon carbide polishing wheels
- Polished finally with rotary tool and jewelry polish

- Lubricated then burnished polished surface
- Removed burnish scratches with rotary tool and jewelry polish

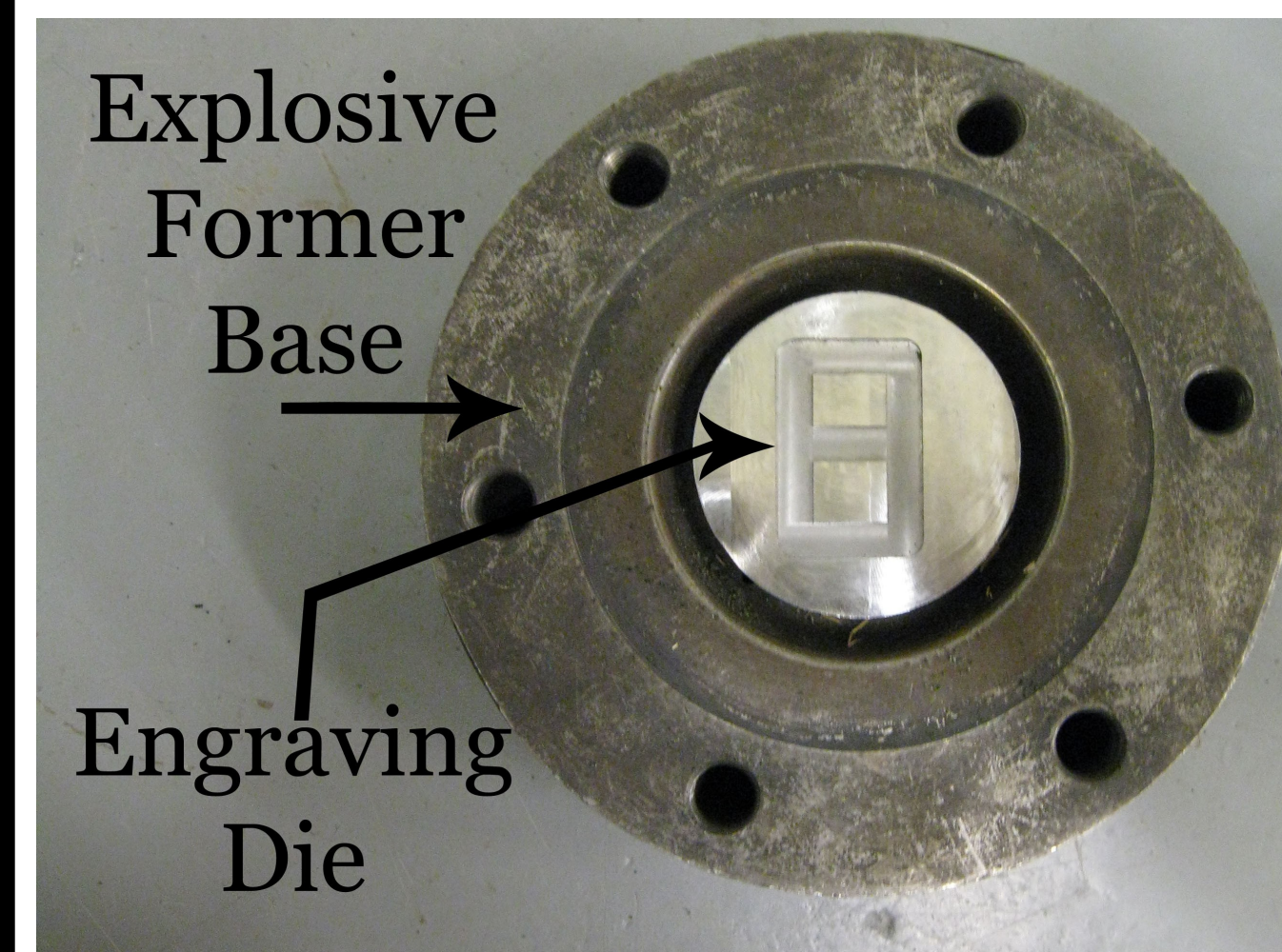


Figure 1: Die in Explosive Former Base

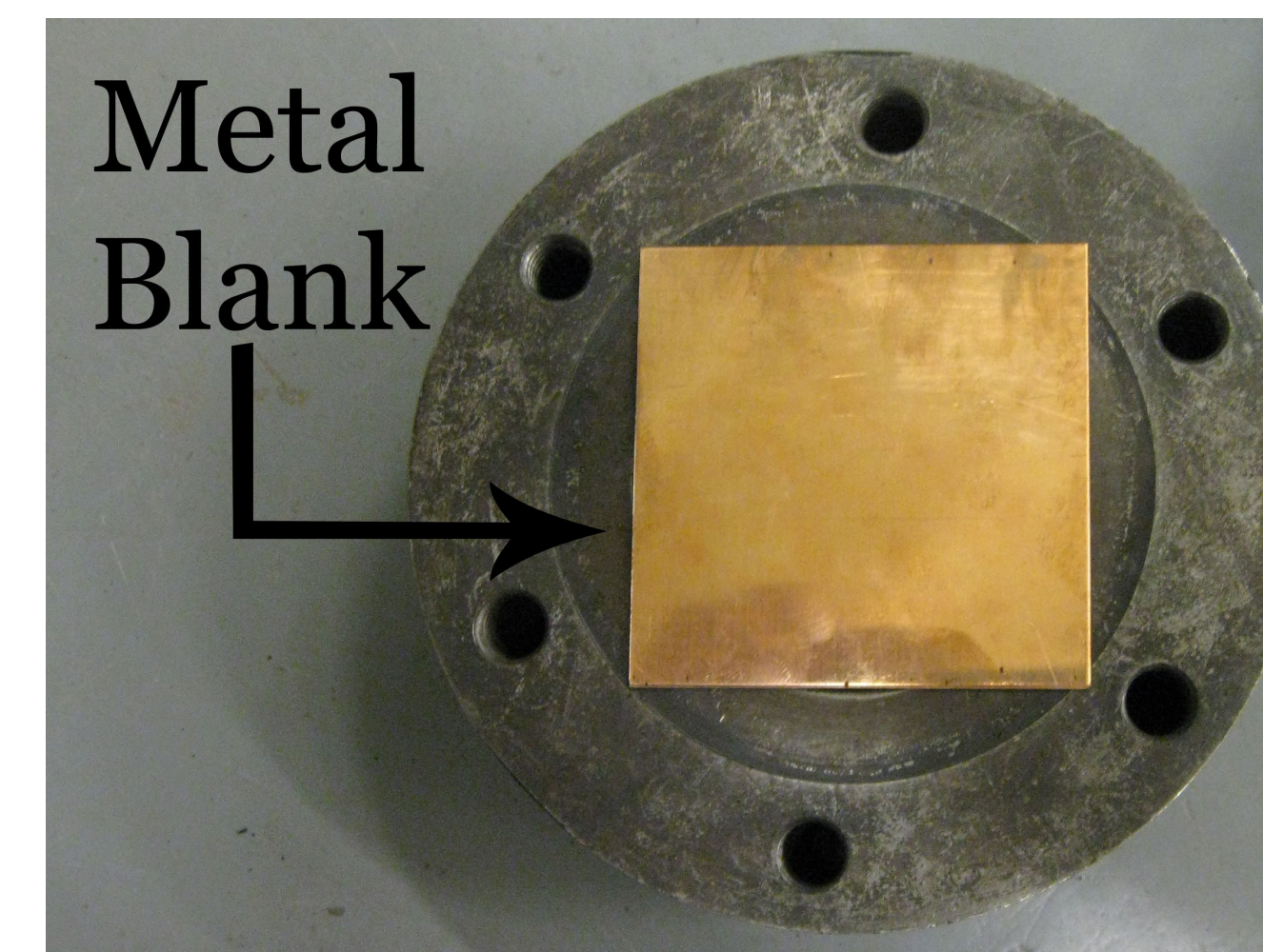


Figure 2: Blank in Explosive Former Base

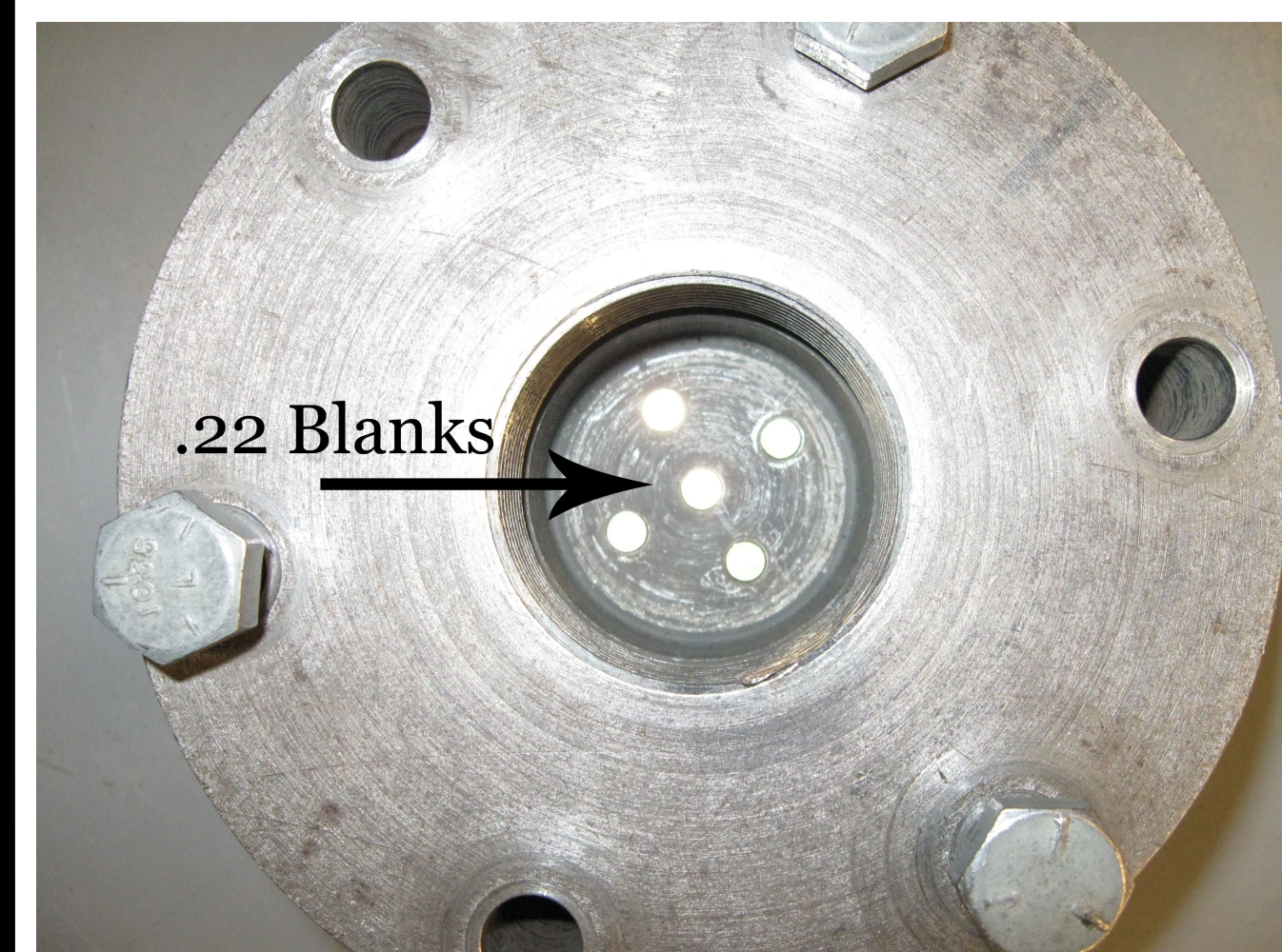


Figure 3: Closed Explosive Former with .22 Caliber Blanks



Figure 3: Explosively Formed Blanks and Engraving Die

Results

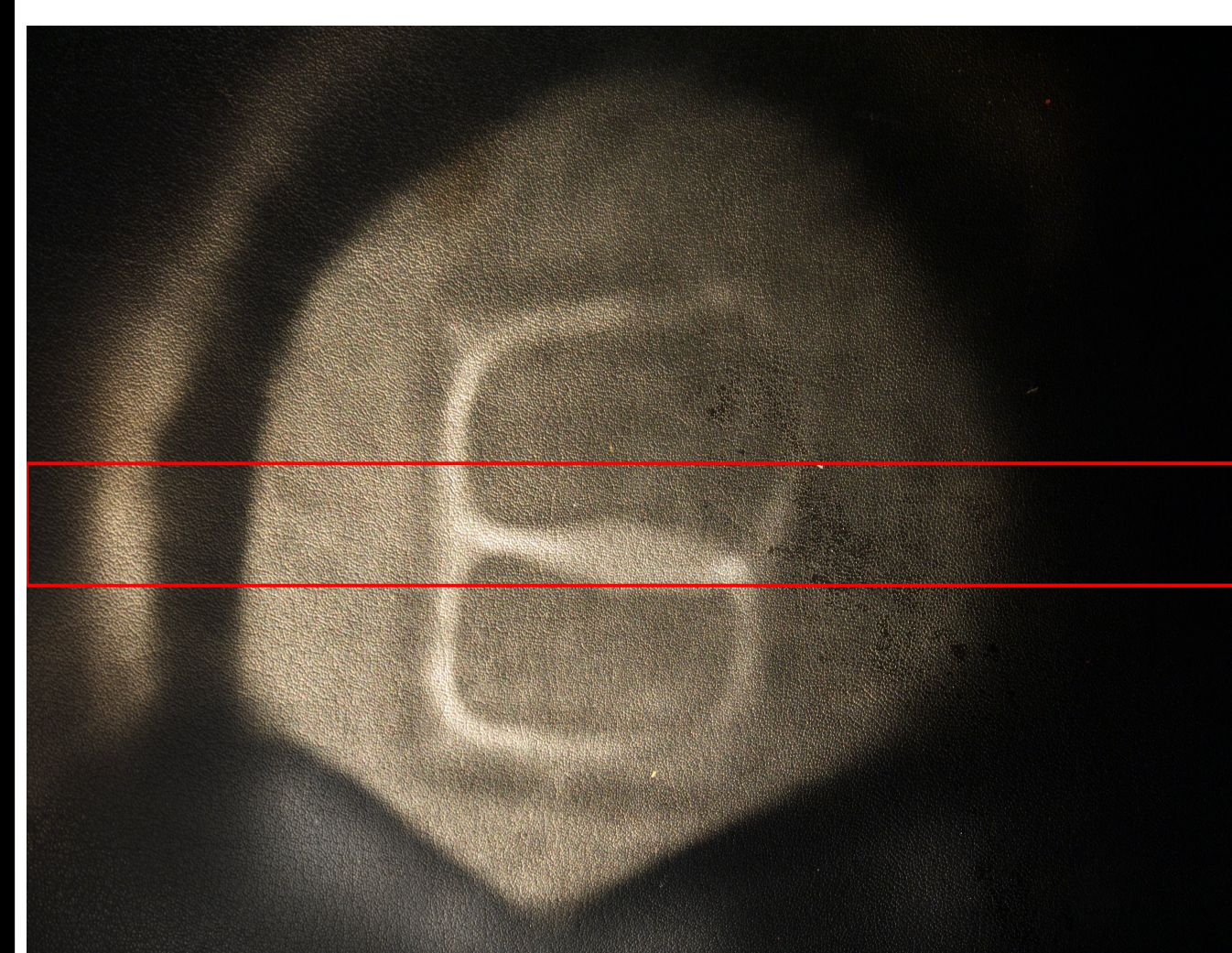


Figure 5: Makyoh Reflection

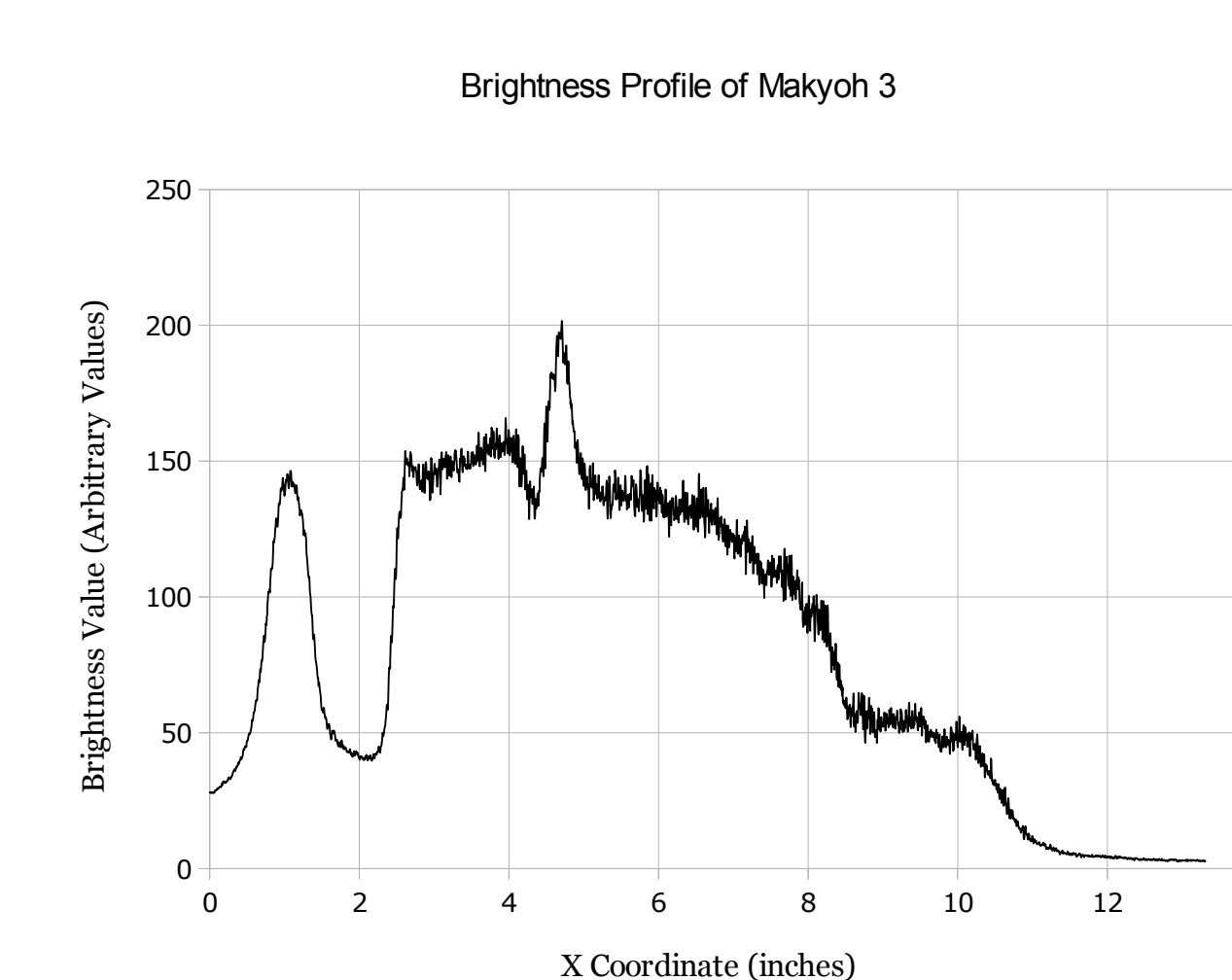


Figure 6: Brightness Profile

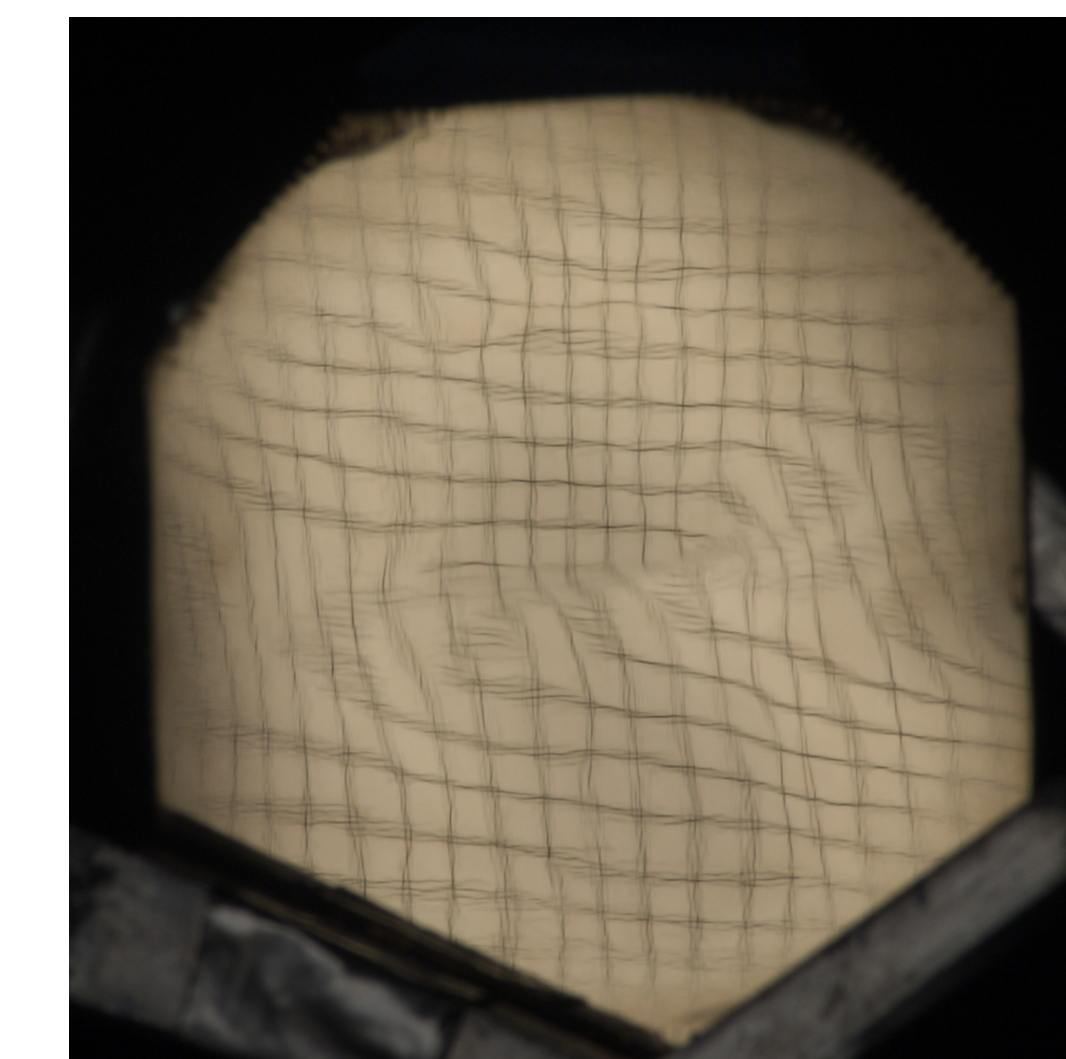


Figure 6: Distortion Test

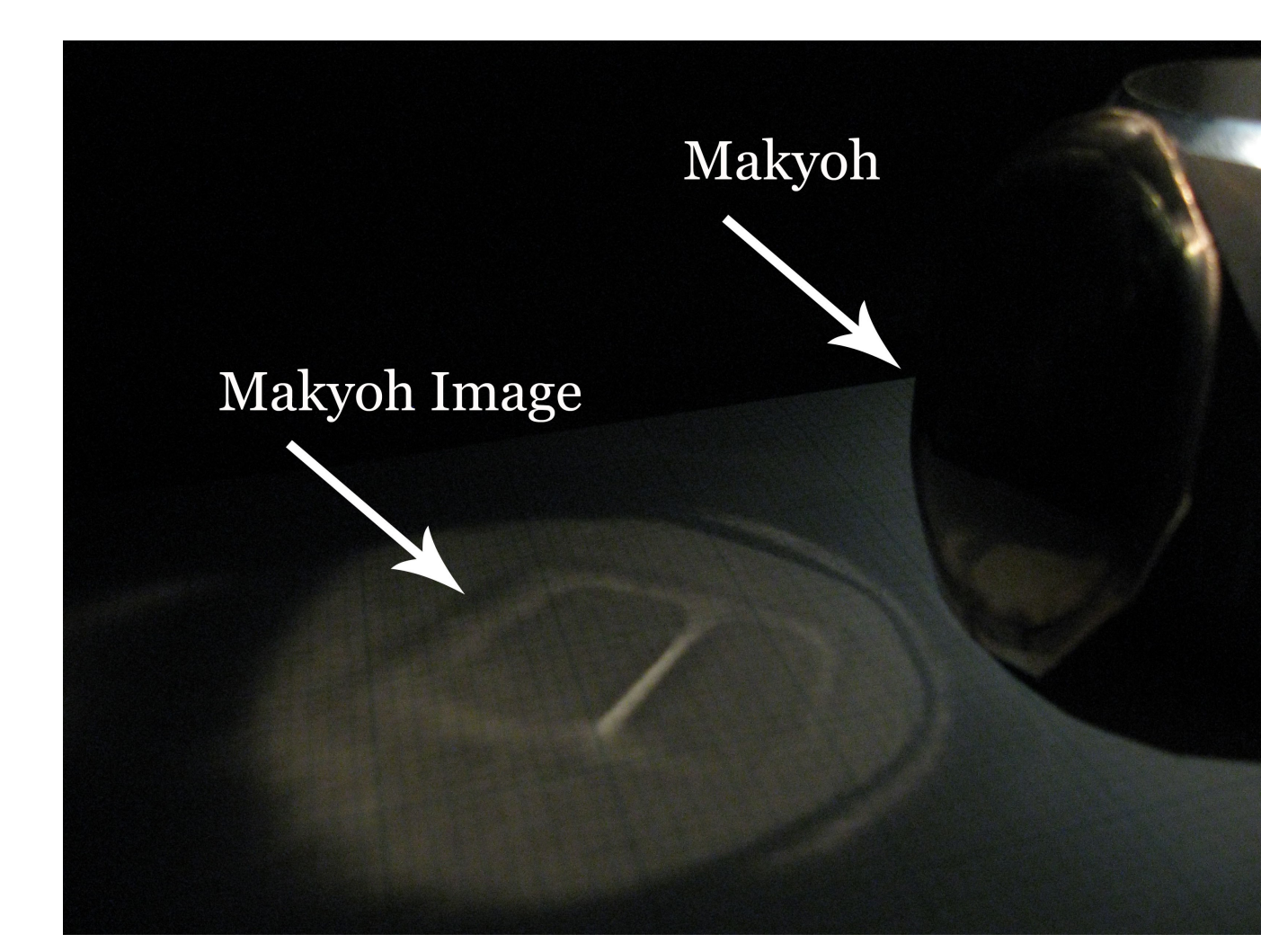


Figure 7: Working Makyoh

Conclusions

- Explosive forming was viable method to create Makyoh
- Burnishing was key to creating a working Makyoh
- Bronze was better suited than brass for Makyoh
- Mirror distortion had minimal impact on image quality

Future Work

- Electro-etch future dies
- Investigate smallest allowable feature size
- Investigate convex dies

Acknowledgments

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References

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