

# Investigation of Potting Compounds for Hermetic Feed-through Applications

Miguel Angel Cabrera  
UCO/Lick Engineering Department  
Center for Adaptive Optics  
University of California, Santa Cruz



# Keck/HIRES assembly

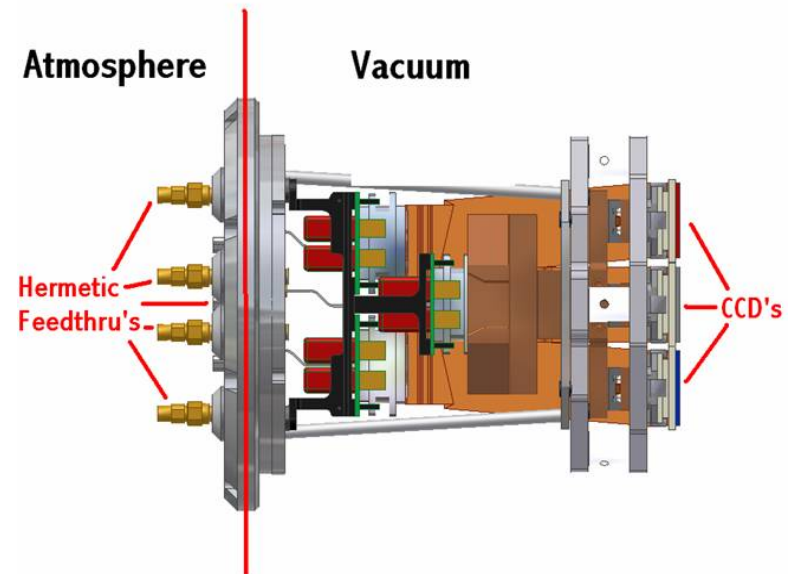
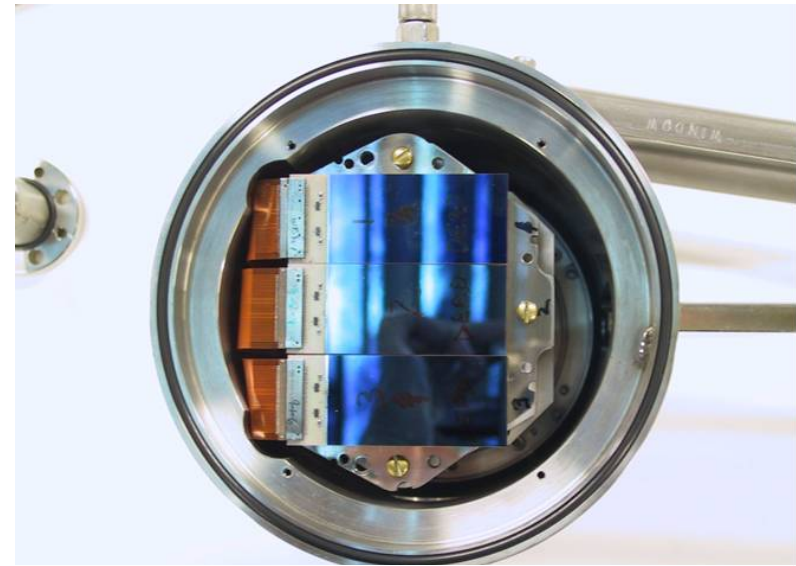
- Worlds largest telescope
- High Resolution Echellette Spectrograph (HIRES)
- HIRES is most complex of Keck's instrumentations
- Complex system of filters, prisms and lenses to a 2K x 2K pixel CCD detector.

[http://www2.keck.hawaii.edu/gen\\_info/kiosk/index.html](http://www2.keck.hawaii.edu/gen_info/kiosk/index.html)

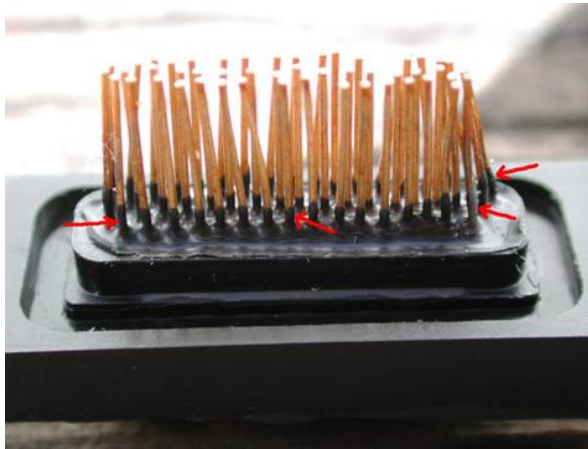
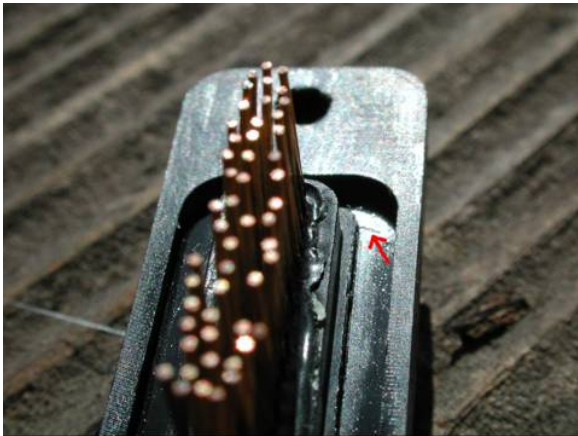


# HIRES CCD Upgrade

- CCD's are contained in a ultra high vacuum environment
- Maintained at extremely cold temperatures in order to maintain precision and sensitivity
- Needed a custom hermetic feedthru connector
- Electrical signals pass from high vacuum environment to atmosphere with Hermetic feedthru's



# Feed-through Connectors



# Requirement for Potting Compound

- Geometrically Stable
- Easy to Mold
- No outgassing
- Electrically nonconductive
- Excellent adherence to other materials/Bonding
- Compatible thermal expansion characteristics
- Easy to mix
- Non-toxic/ non-hazardous

# Objective

- Find and Select Potential Potting Compounds
- Perform various test to determine quality of potting compounds
- Test specimen unit component

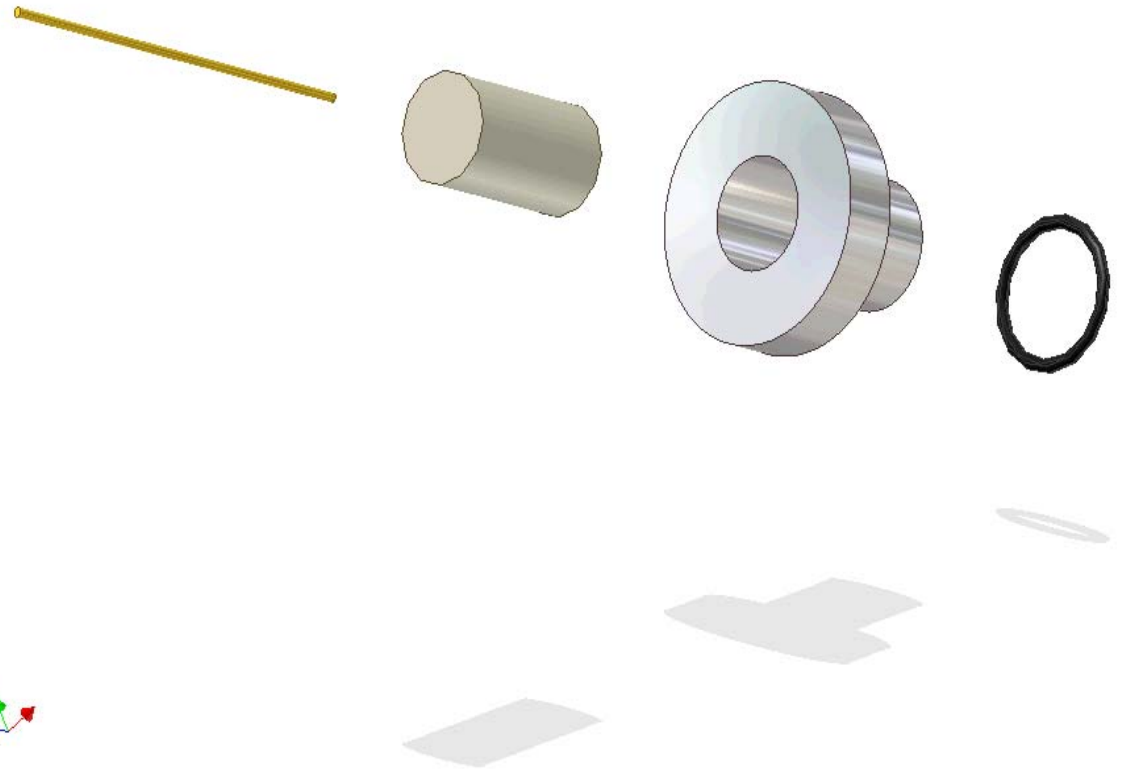
# Potential Potting Compounds

	Outgassing Rate (cc/sec)	Volume Resistivity (ohm-cm)	Cure time (hours)	Cost (\$)
TorrSeal	$10^{-9}$	$3.52 \times 10^{14}$	2	76.00
VS-101	$10^{-9}$	n/a	2	18.00
KI-320K	$10^{-5} - 10^{-7}$	$6 \times 10^{13}$	18	78.00



# Preparations

- Instrumentation design for leak detector
- Instrument
- Potting Scheme
- Final Product



# Preparations

- Instrumentation design for leak detector
- **Instrument**
- Potting Scheme
- Final Product



# Preparations

- Instrumentation design for leak detector
- Instrument
- Potting Scheme
- Final Product



# Preparations

- Instrumentation design for leak detector
- Instrument
- Potting Scheme
- **Final Product**



# Testing

- Potting Compounds Tested
  - Total Mass Loss
  - Leak Test @ room Temp
  - Leak Test @  $-120^{\circ}\text{C}$



# Results

	Total Mass Loss (%)	Leak Rate Room Temperature (cc/Sec)	Leak Rate -120 °C (cc/Sec)
Control	n/a	$.2 \times 10^{-9}$	n/a
Torr Seal	.9%	$.2 \times 10^{-9}$	$.2 \times 10^{-9}$
VS-101	1.1%	$.2 \times 10^{-9}$	$.2 \times 10^{-9}$
KL-320K	.9%	$.2 \times 10^{-9}$	Failed

# Conclusion

- Torr Seal and VS-101 surpassed KL-320K
- Difficult to distinguish between Torr Seal and VS-101
- Torr Seal and VS-101 excellent candidates for molding custom feedthru's

# Further Studies

- Additional Materials
  - Hysol EE 4215 with several Hardners.
- More test
  - Heat Specimens
  - Temperature Cycle
  - Shock/Vibration
- Make Connector

# References

- [1] [http://www2.keck.hawaii.edu/gen\\_info/kiosk/index.html](http://www2.keck.hawaii.edu/gen_info/kiosk/index.html)
- [2] Hires CCD Upgrade for the Keck 1 Telescope, Mauna Kea, Hawaii Project Plan, Pg.3/20.
- [3] Jerry Cabak, UCO/Lick Engineering.
- [4] Terry Pfister, UCO/Lick Instrument Shop.

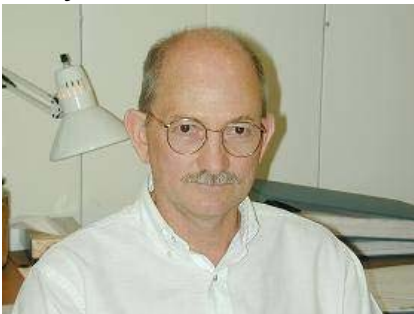
# Acknowledgements

Special thanks to the entire crew at Lick Engineering and CfAO.



But especially to my wonderful research supervisors:

Jerry Cabak



Terry Pfister



And the lovely ladies at CfAO:

Hilary

Malika

Lisa



● “Funding provided through a Research Experiences for Undergraduates (REU) Supplement to the Center for Adaptive Optics, a National Science Foundation Science and Technology Center (STC), AST-987683”