



# Ultra-Stable ALLVAR Alloy Development for Space Telescopes

Presenter: James A. Monroe

ALLVAR: Jay Zgarba, Jeremy McAllister

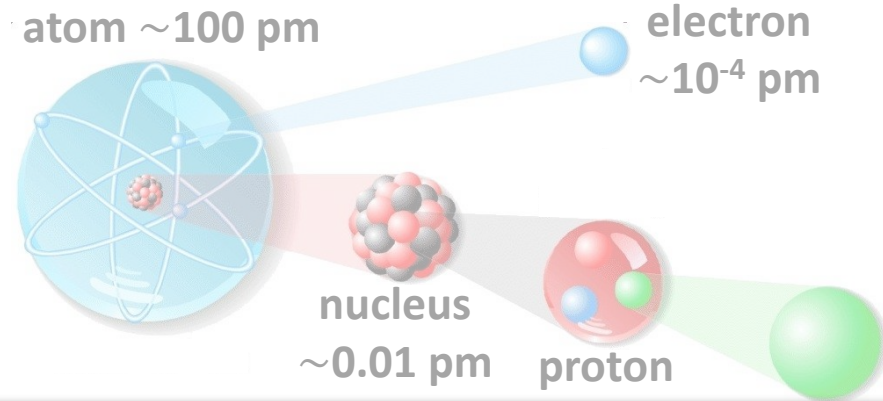
University of Florida: Guido Muller, Paul Fulda, Luis Ortega

18<sup>th</sup> Annual Mirror Technology SBIR/STTR Workshop

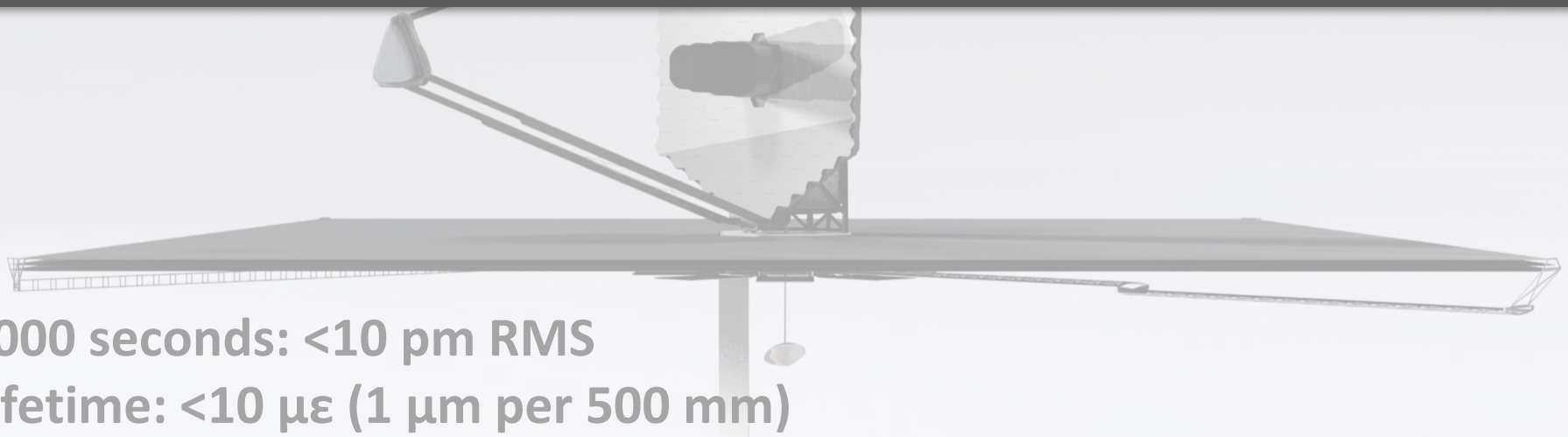
November 6, 2018

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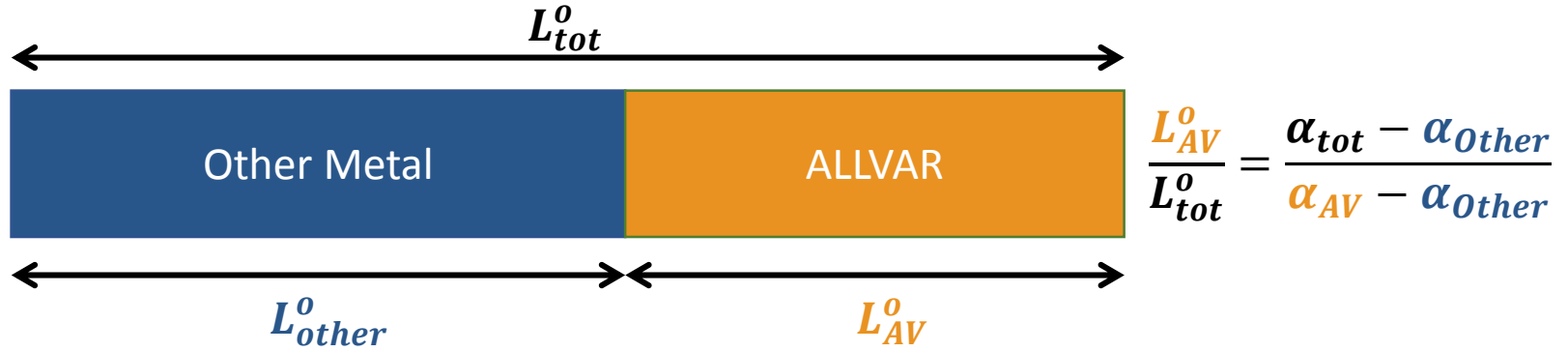
# Motivation – Ultra Stability



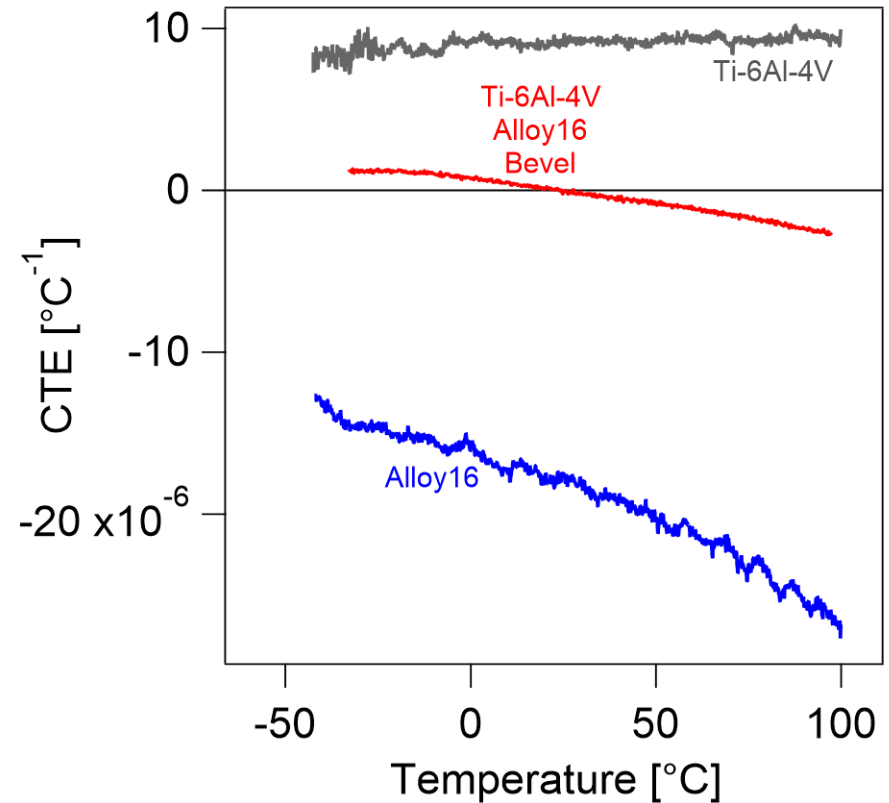
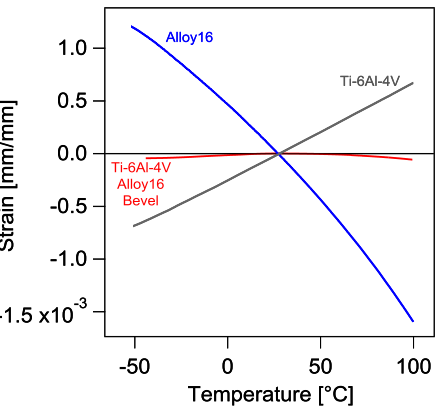
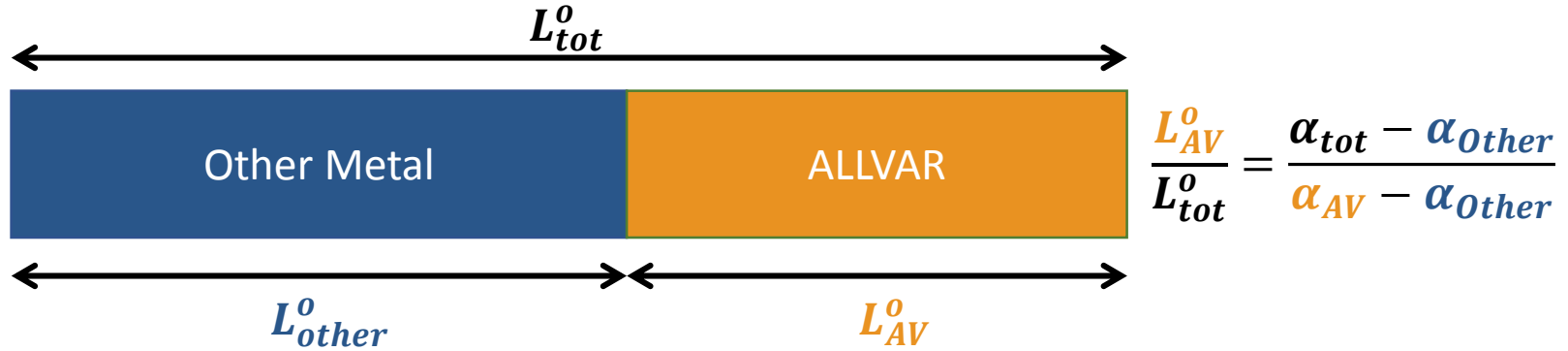
- 1) Can the CTE be tuned for high thermal stability?
- 2) What is the micro-yield stress?
- 3) Can we use ultra-stable bonding techniques to attach mirrors?
- 4) What is the material's long term dimensional stability?



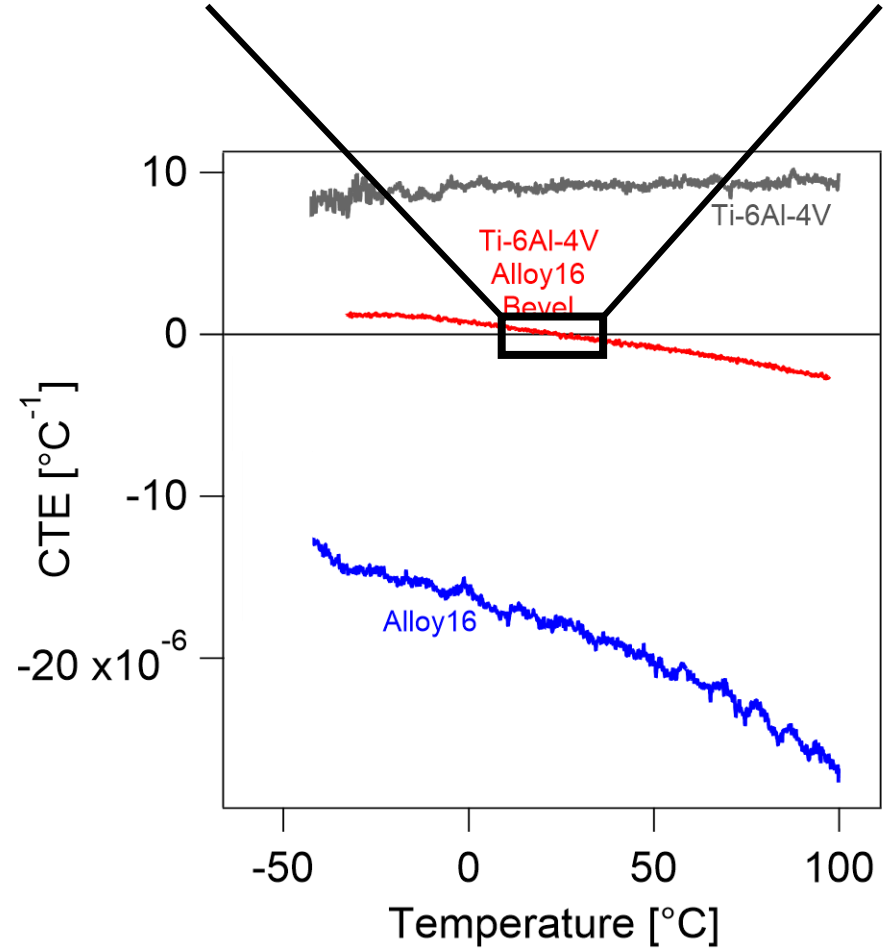
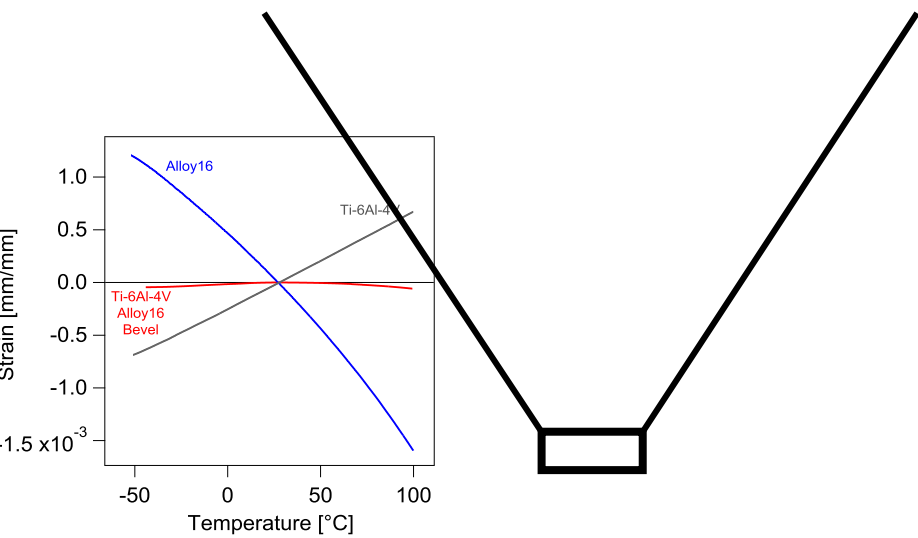
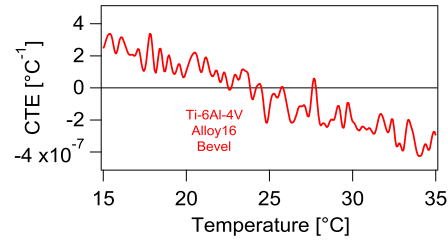
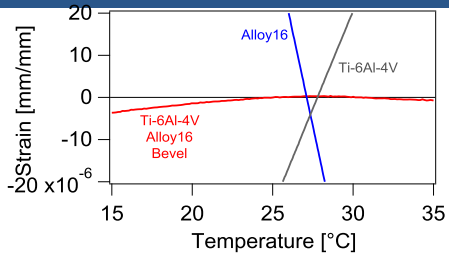
# CTE Tuning



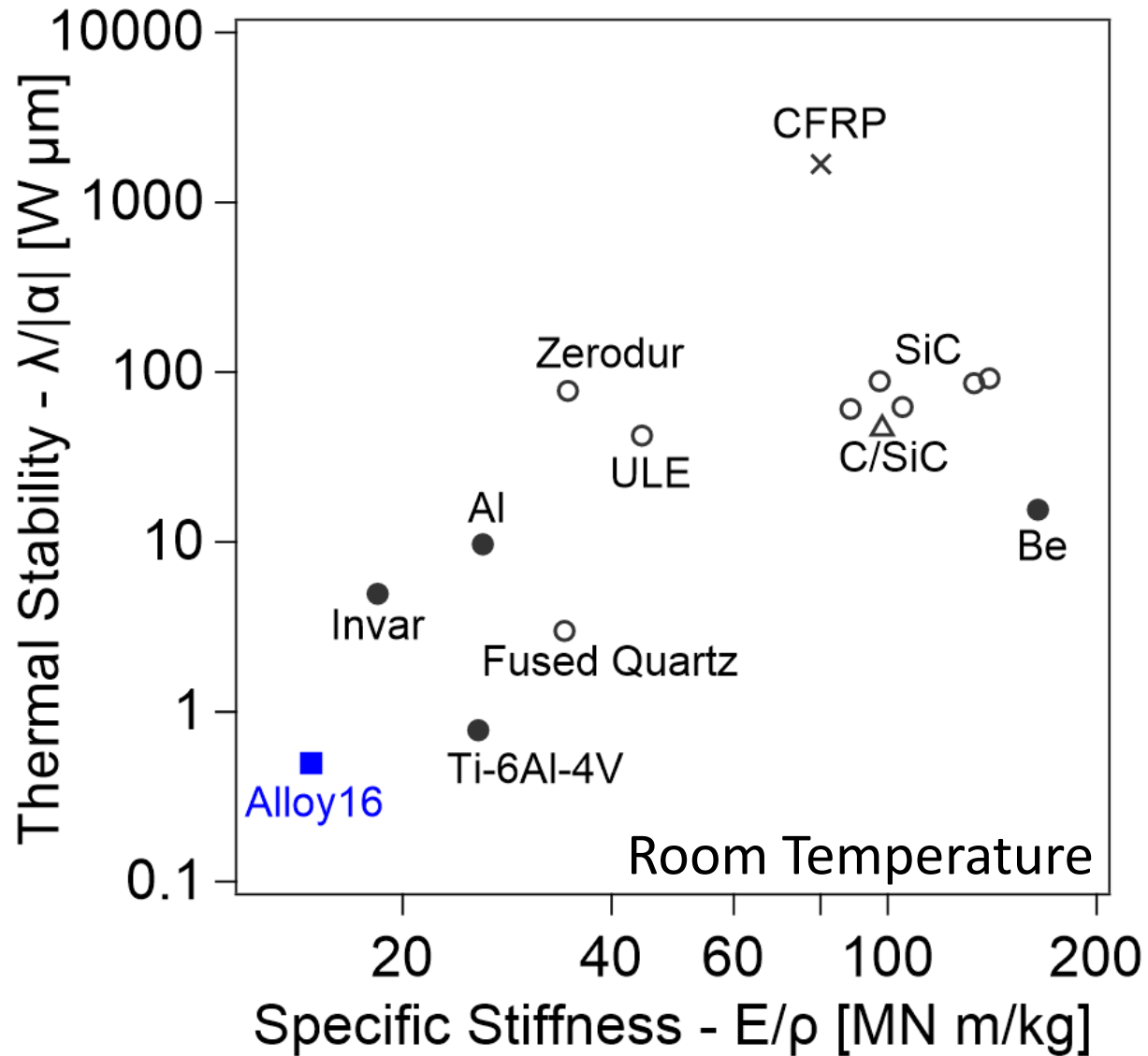
# CTE Tuning



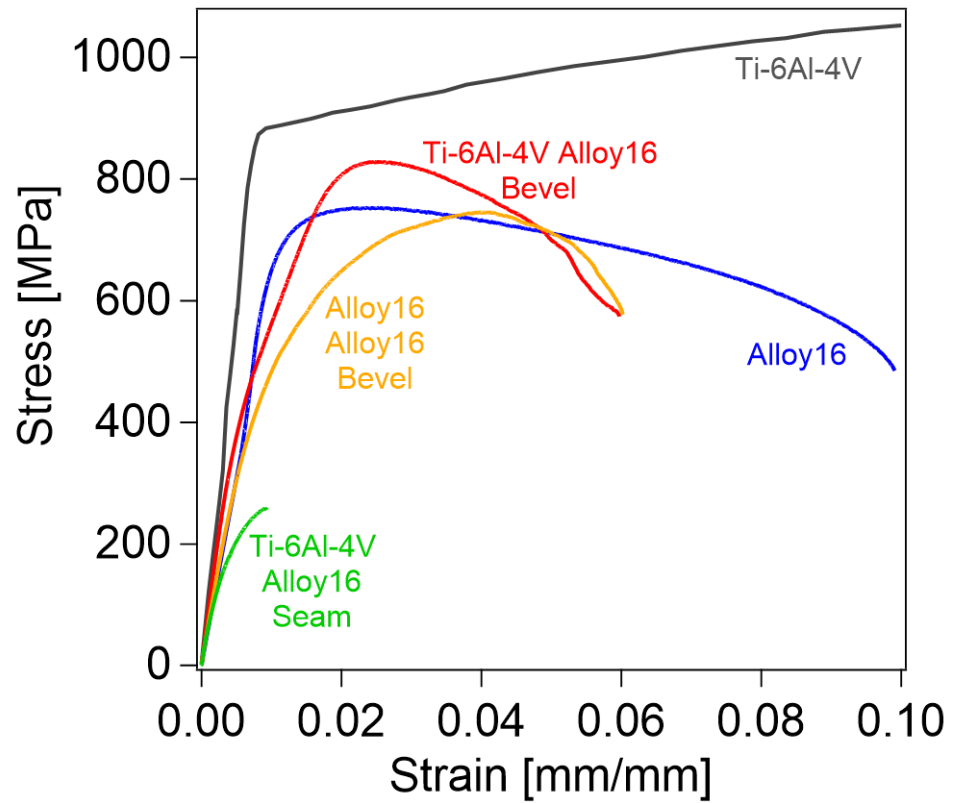
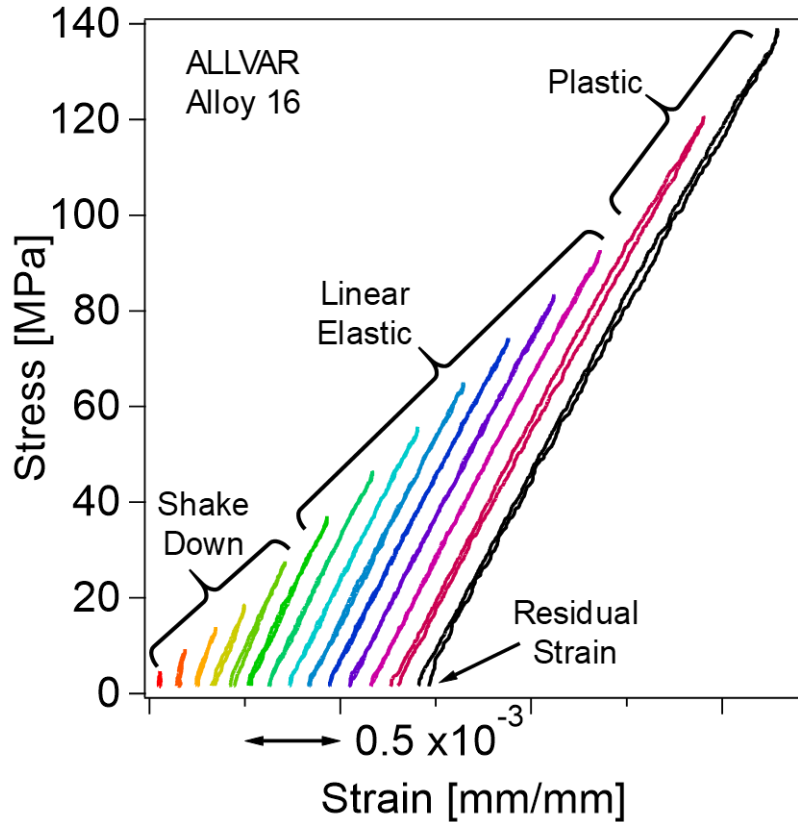
# CTE Tuning



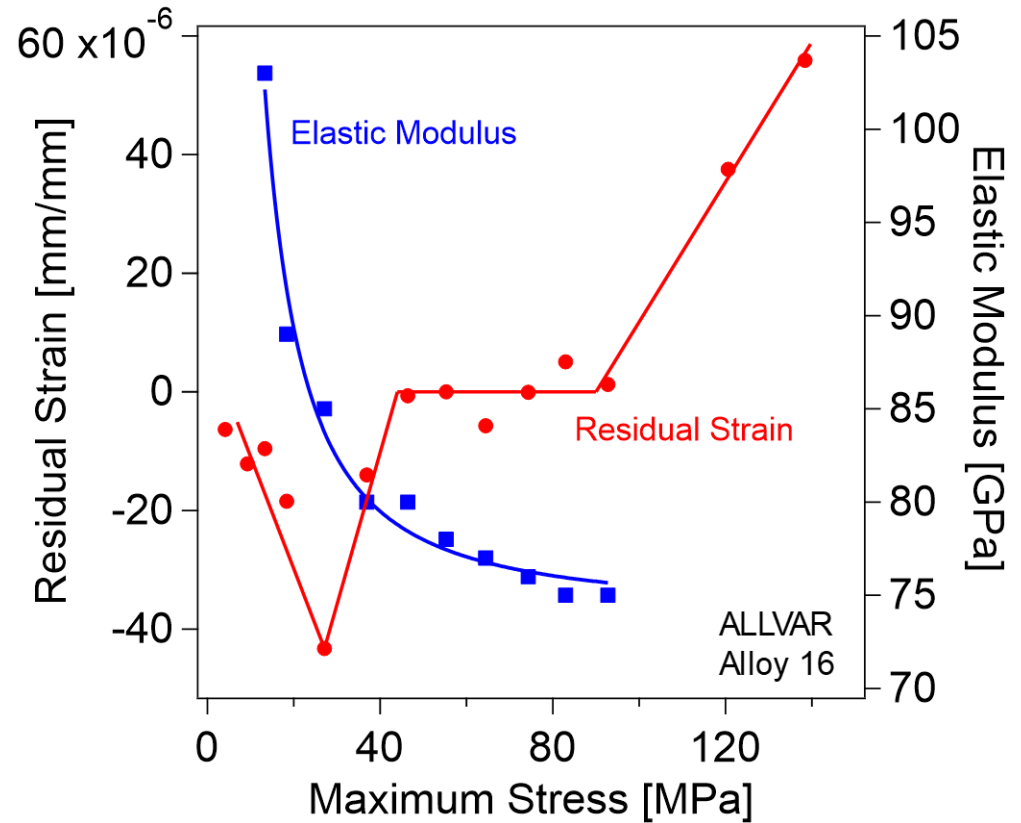
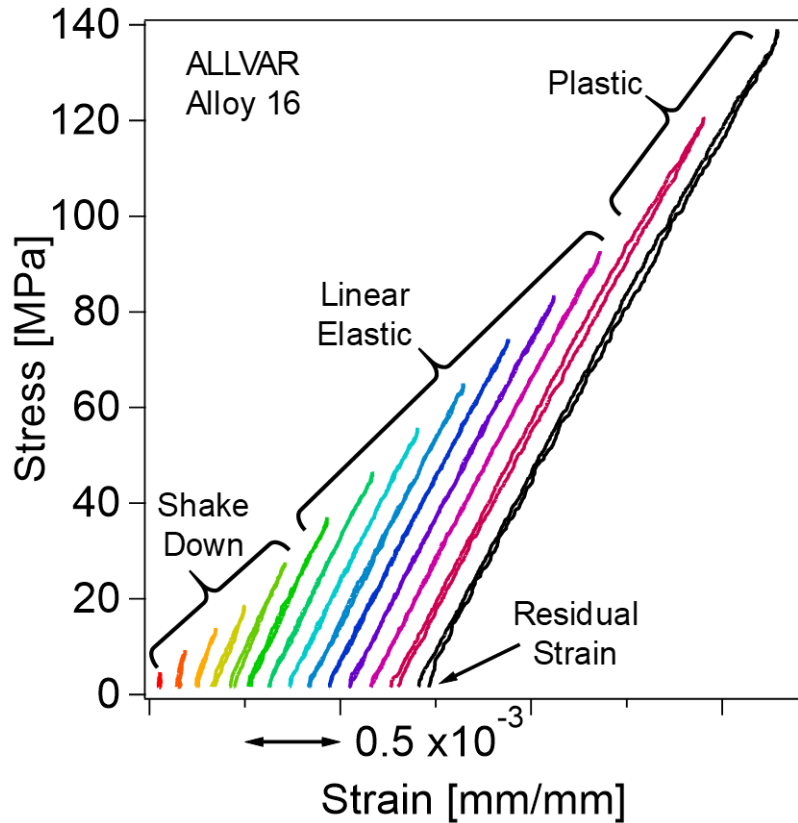
# CTE Tuning



# Micro-Yield

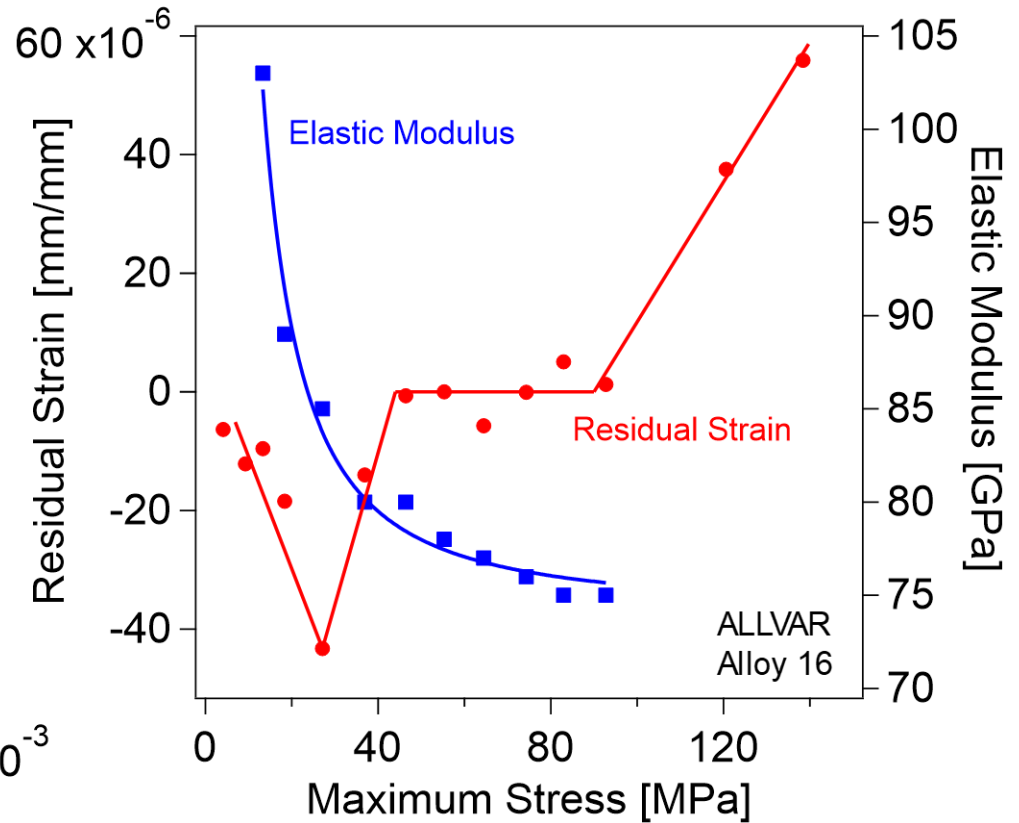
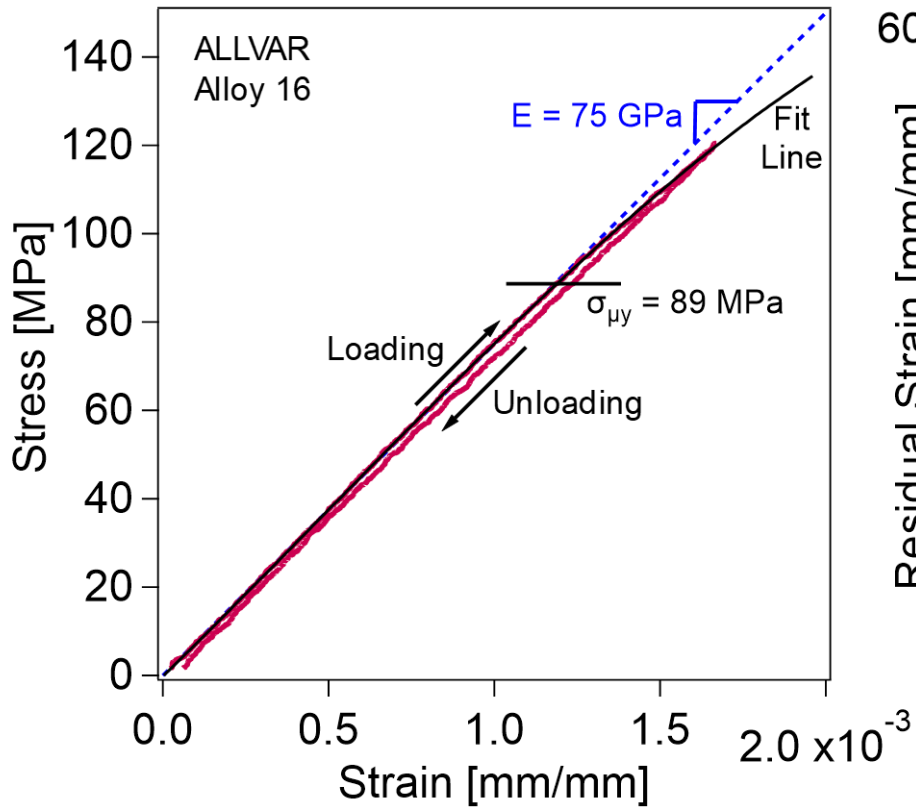


# Micro-Yield





# Micro-Yield



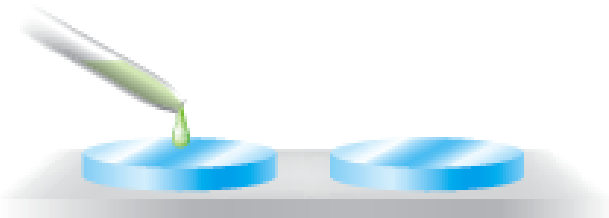
# Mirror Bonding

①



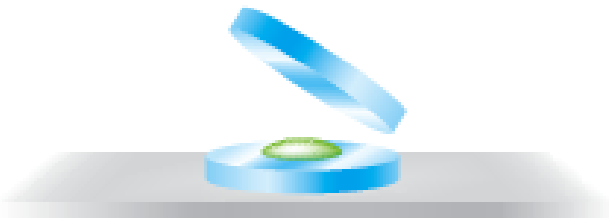
**Prepare Surfaces**

②



**Apply Hydroxide Solution**

③



**Put Surfaces In Contact**

④



**Room Temperature Cure**



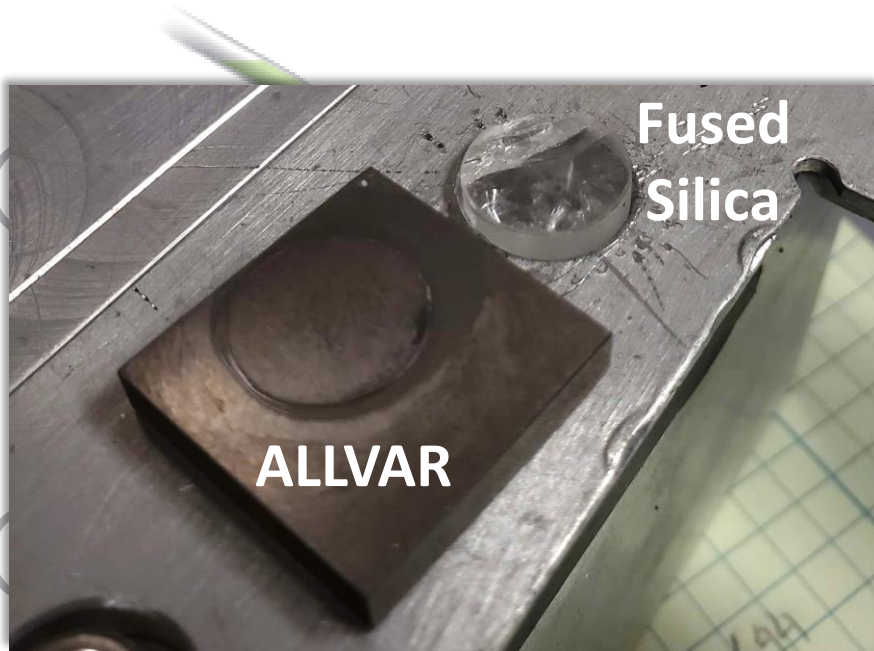
Robertson D. et. al. 2005 Class. Quantum Grav. 22 S155

# Mirror Bonding

1



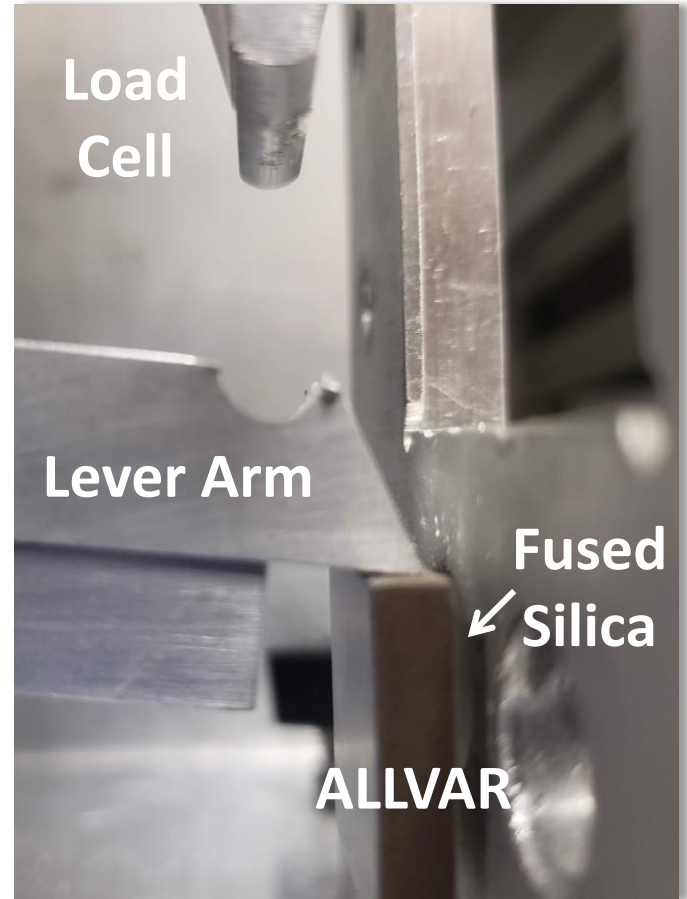
**Prepare Surfaces**



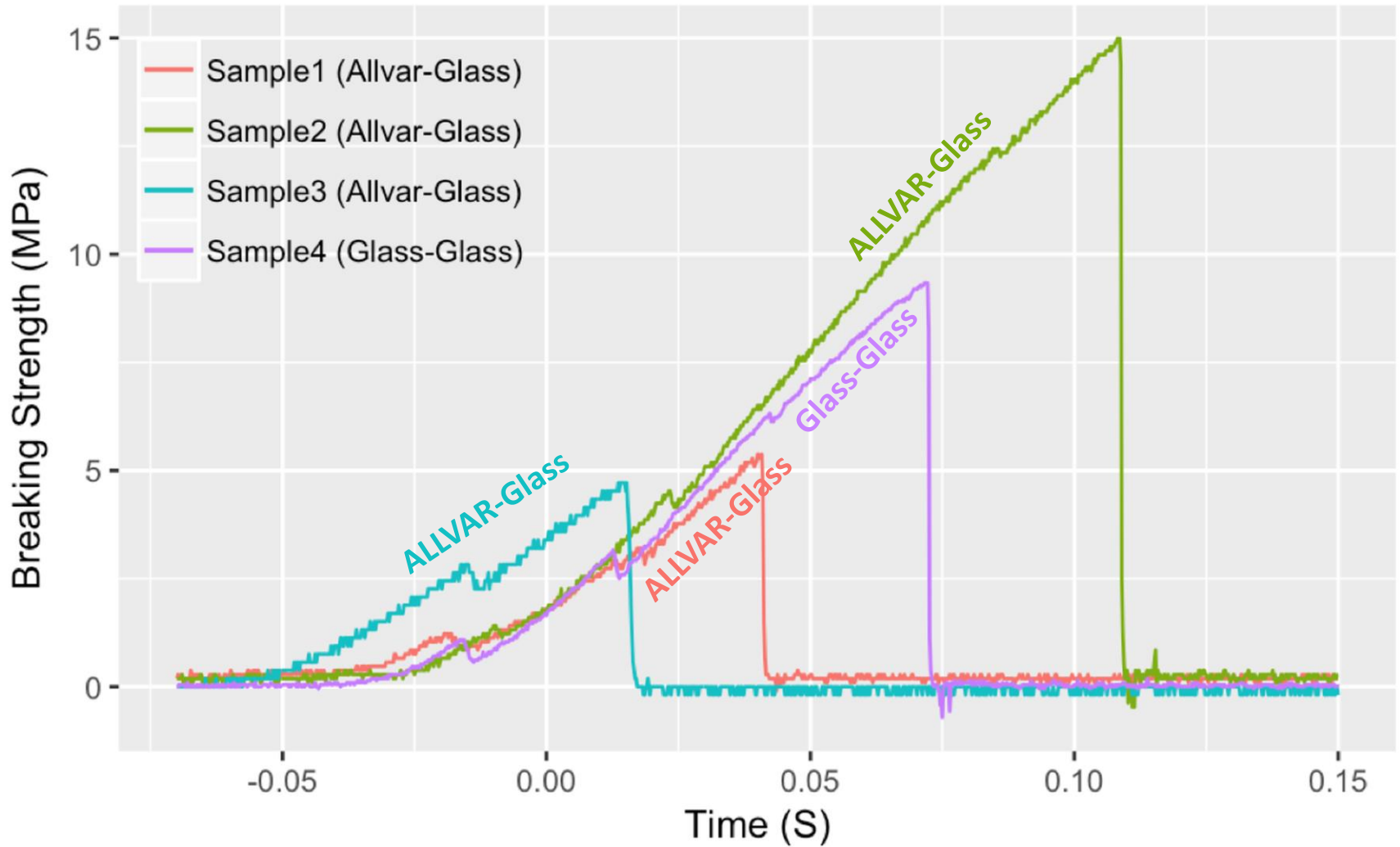
4



**Room Temperature Cure**

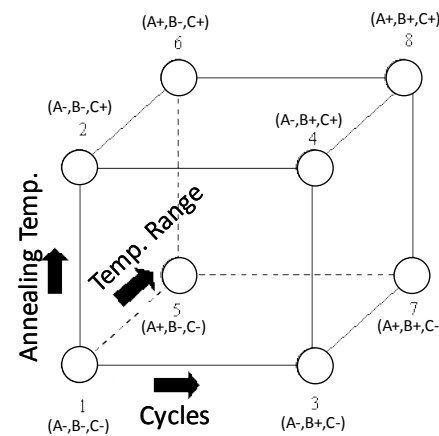
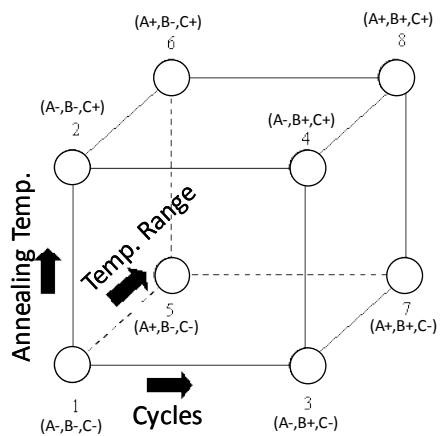
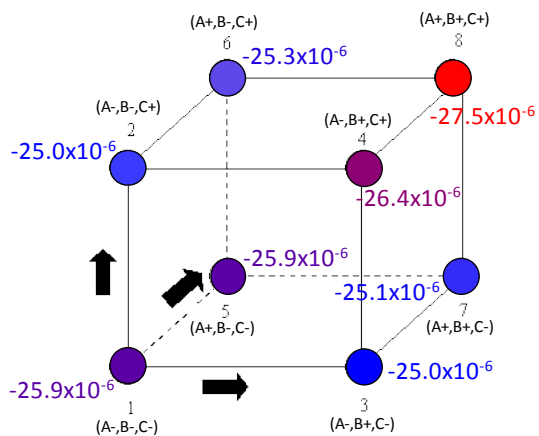
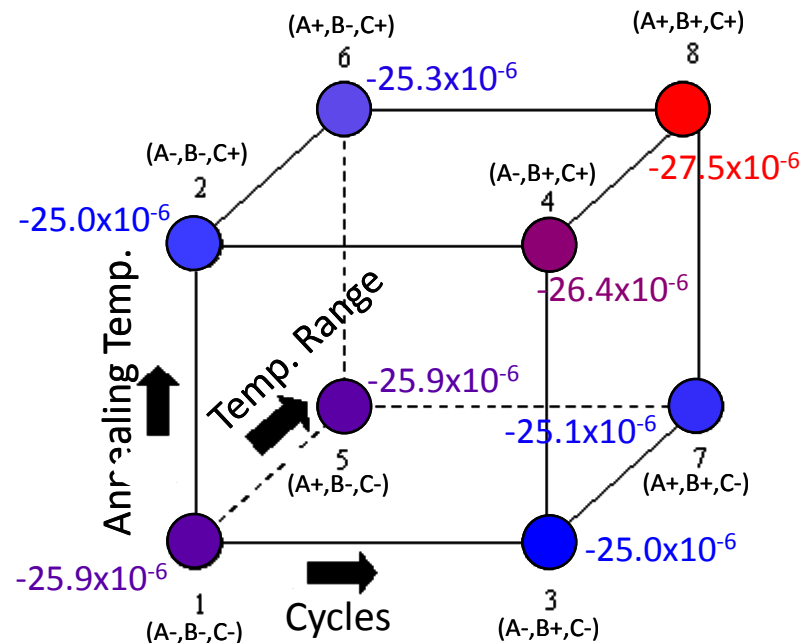


# Mirror Bonding



# Temporal Stability

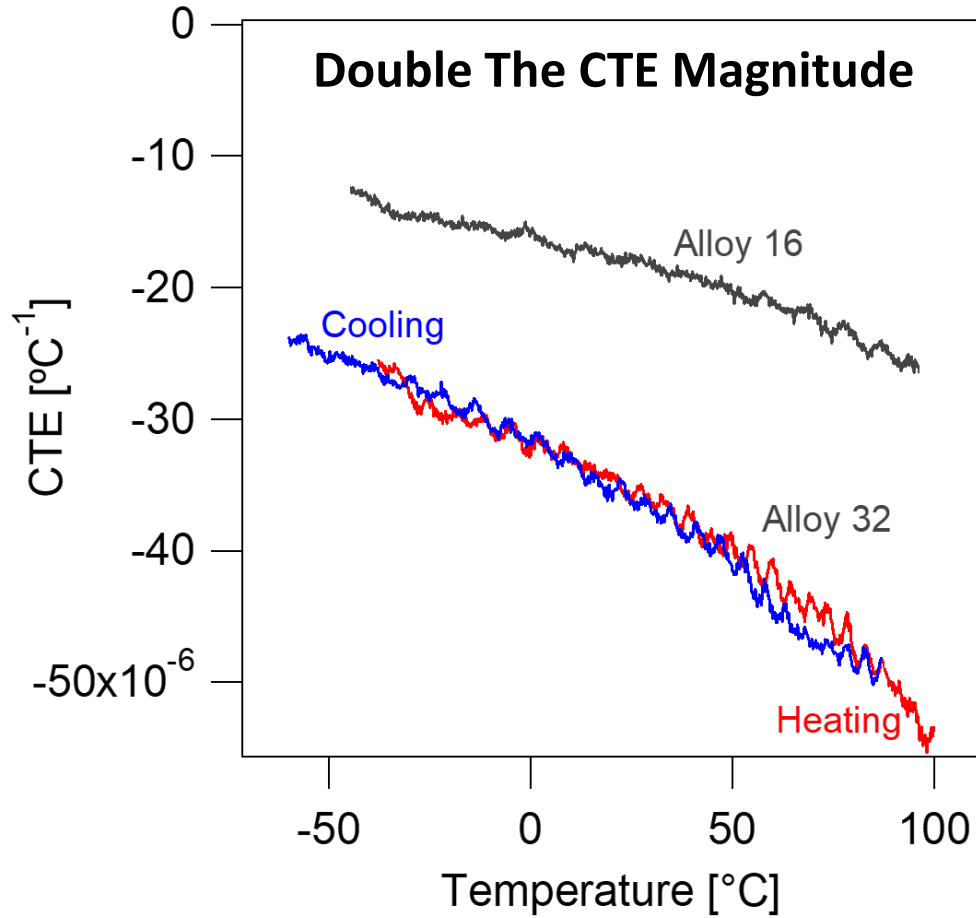
Condition	Samples Prepared	Stabilization Factors		
		A	B	C
1	3	-	-	-
2	3	-	-	+
3	3	-	+	-
4	3	-	+	+
5	3	+	-	-
6	3	+	-	+
7	3	+	+	-
8	3	+	+	+
0	3	Control	Control	Control



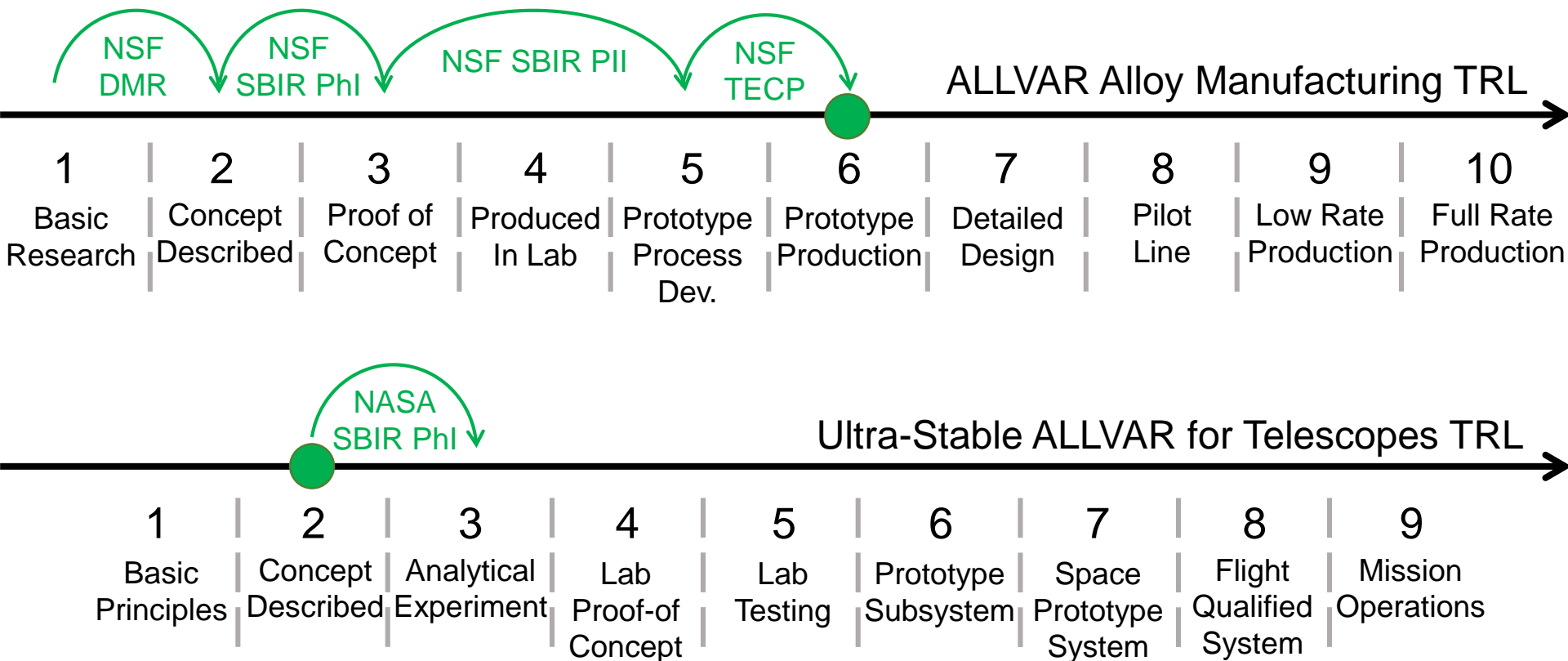
Time



# New Capabilities

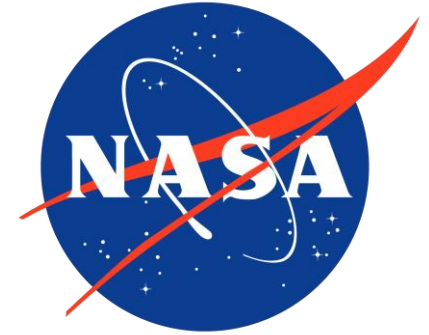


# Past, Present, and Future



## Outstanding Questions

- 1) What is the long term dimensional stability of ALLVAR Alloys?
- 2) What is the achievable CTE tolerance using hydroxide bonding?
- 3) How does radiation affect dimensional stability?
- 4) Other Questions...



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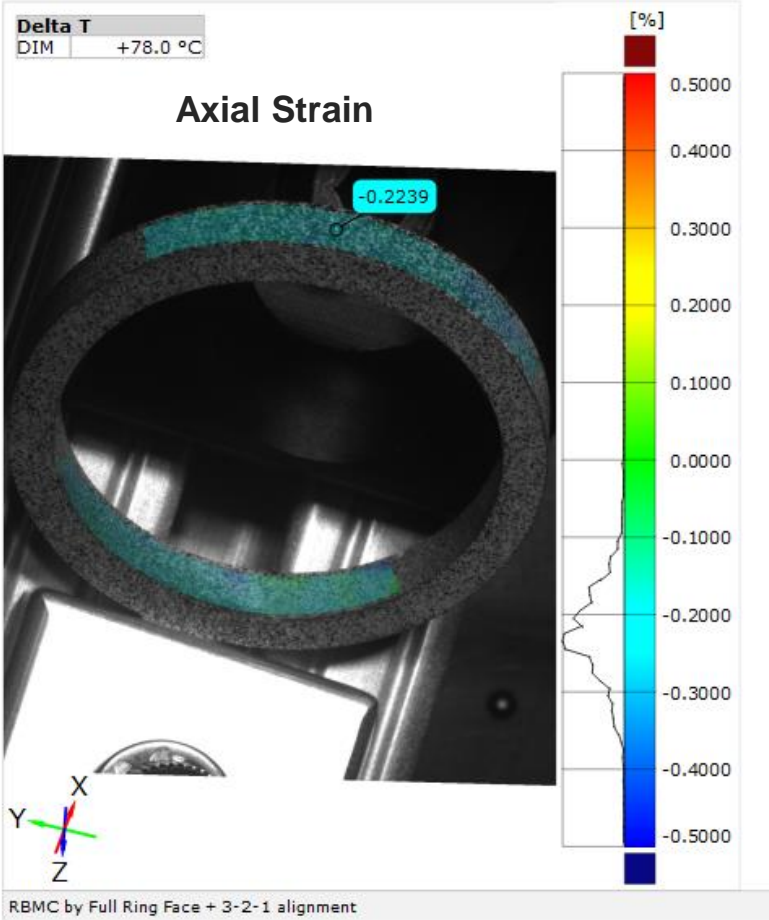
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# Backup Slide 1

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