



ALLVAR

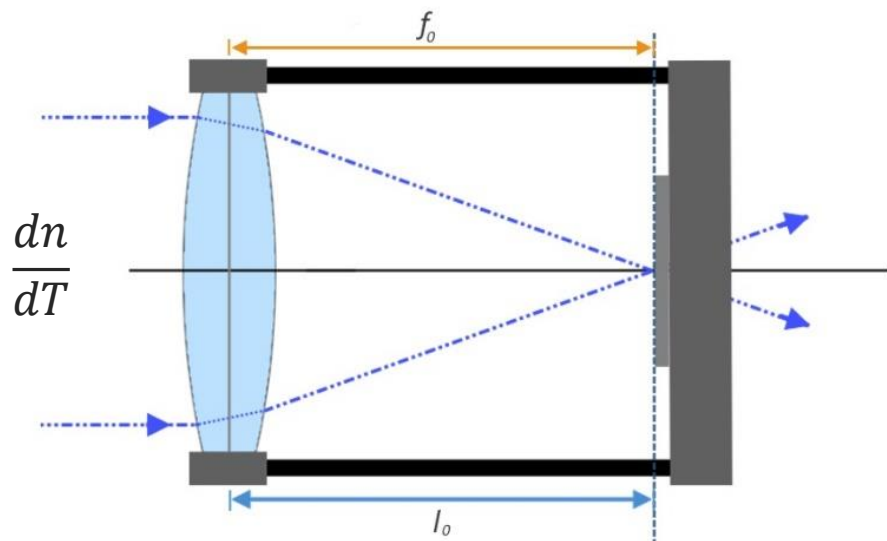
Tailored CTE Alloys for Stable Optics

James A. Monroe

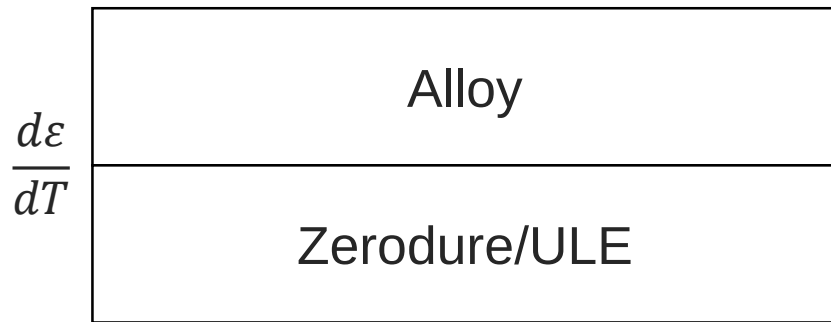
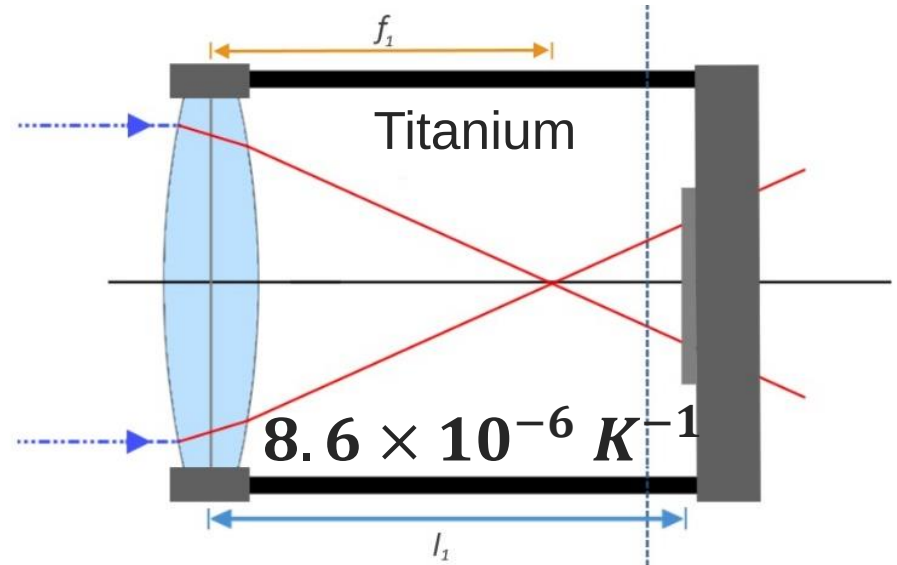
Jay Zgarba

Ibrahim Karaman (Texas A&M)

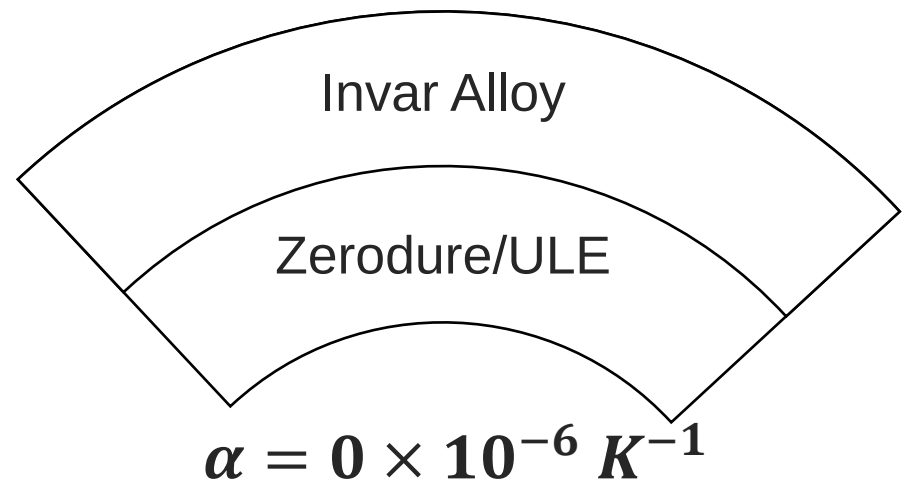
Room Temperature



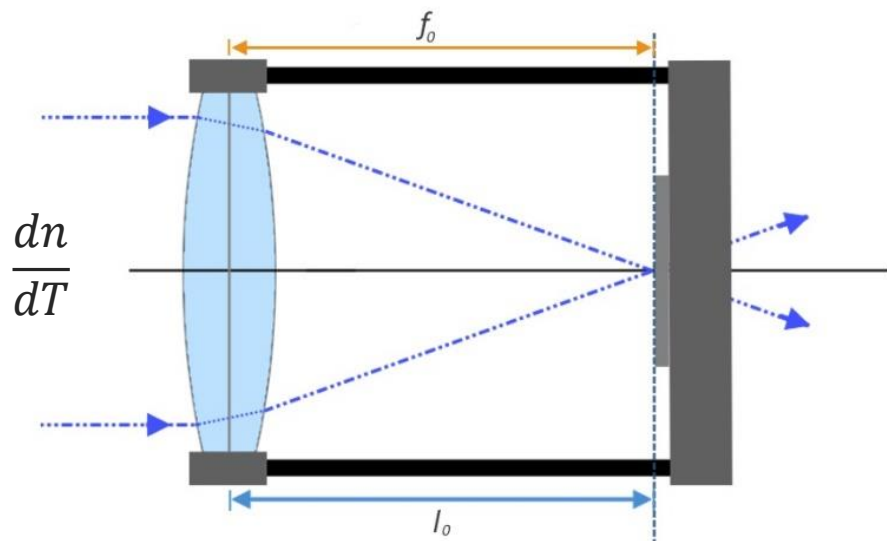
80°C



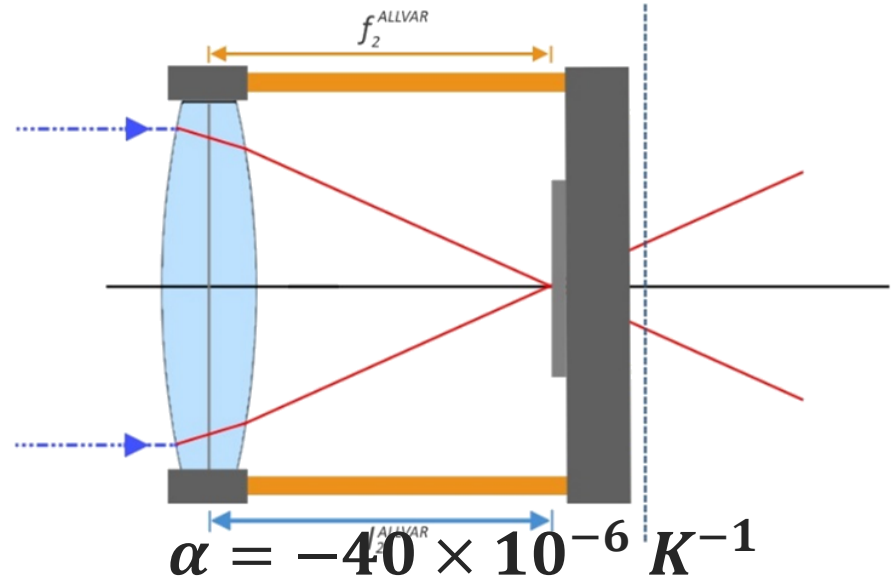
$$\alpha = 1.2 \times 10^{-6} K^{-1}$$



Room Temperature



80°C



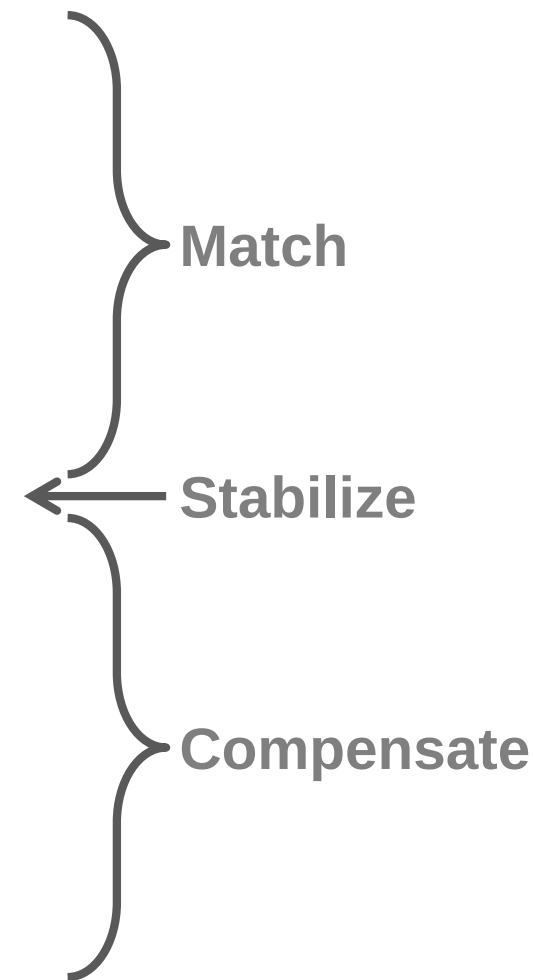
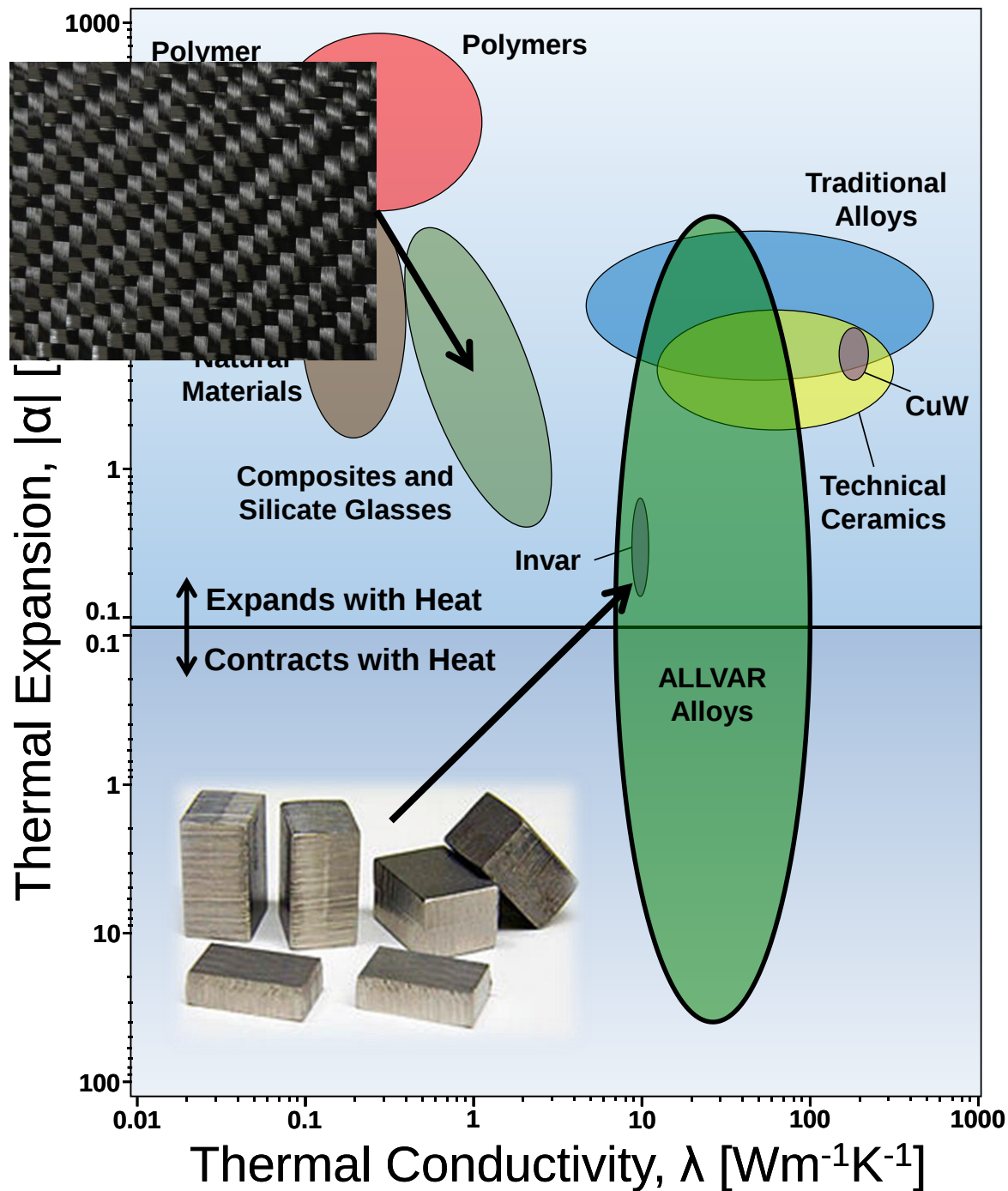
$$\alpha = 0 \times 10^{-6} K^{-1}$$

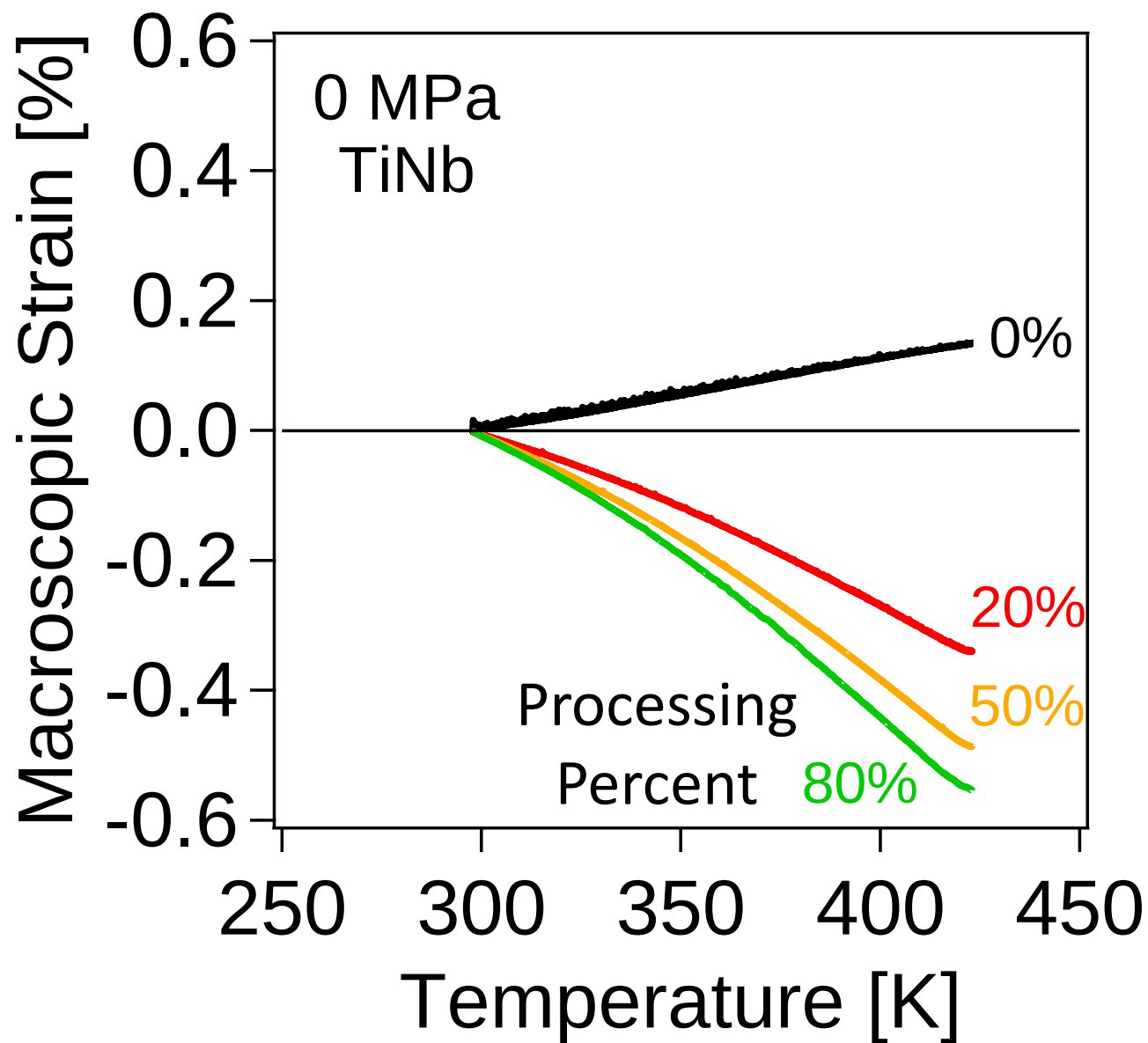
$$\frac{d\varepsilon}{dT}$$

Alloy
Zerodure/ULE

ALLVAR Alloy
Zerodure/ULE

$$\alpha = 0 \times 10^{-6} K^{-1}$$





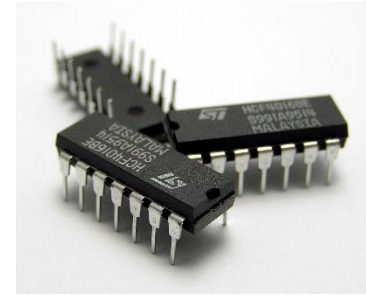
Innovation Timeline



1896
Invar



1920

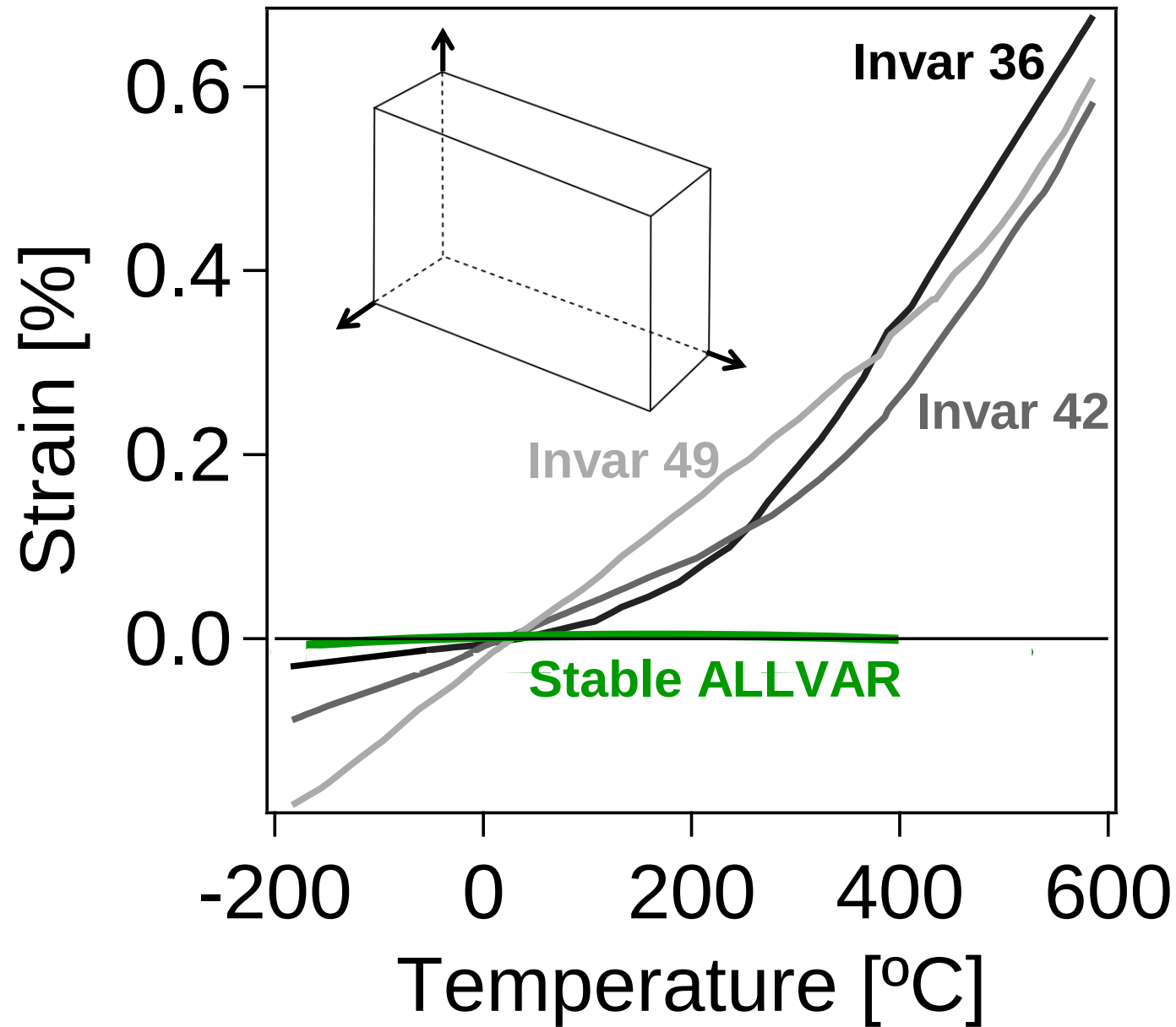


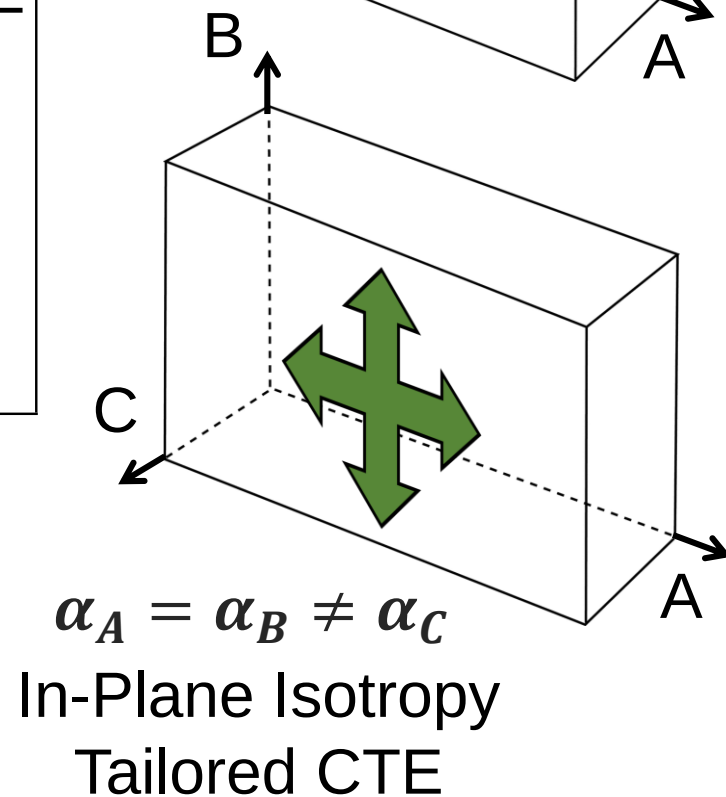
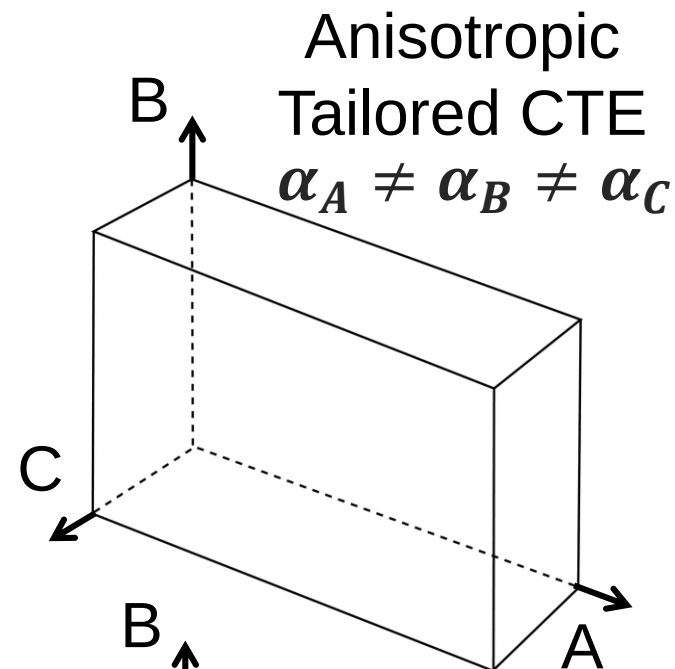
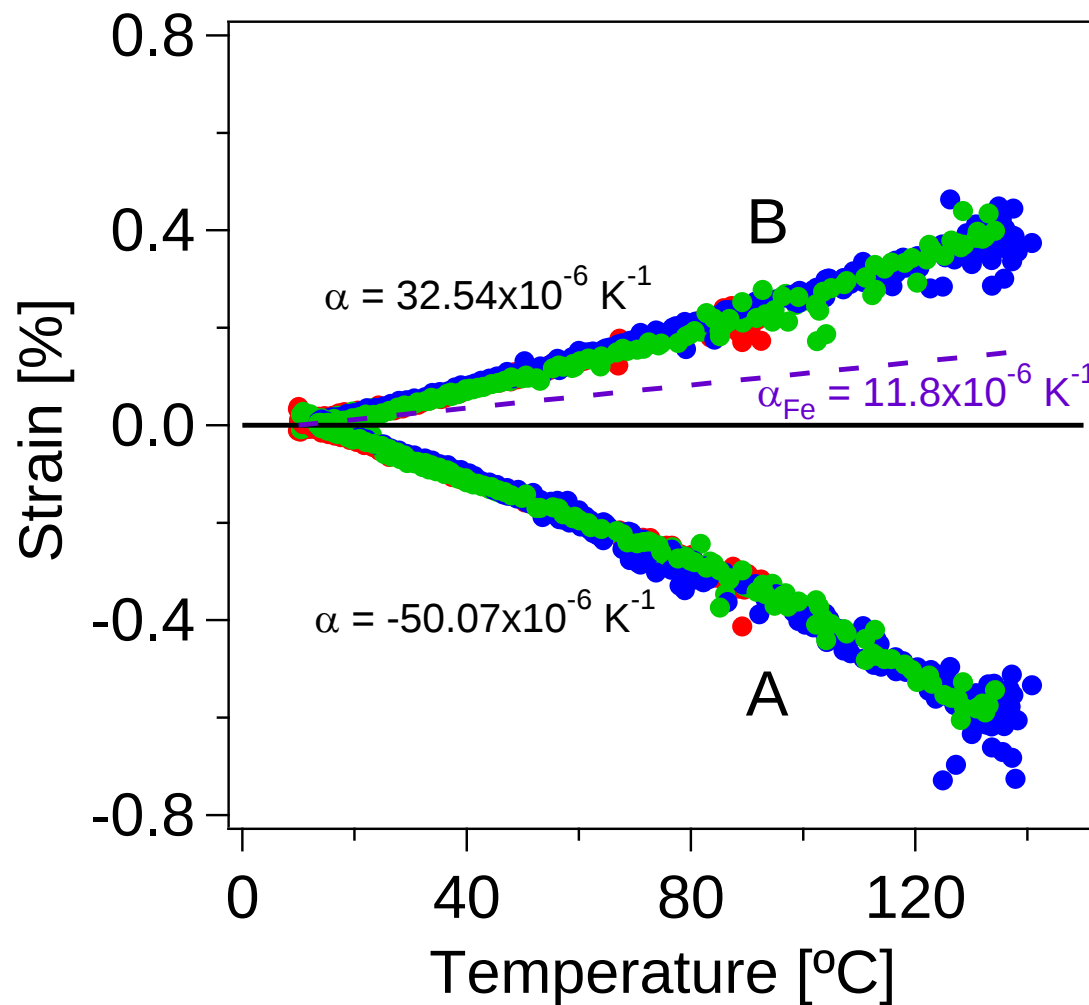
1980

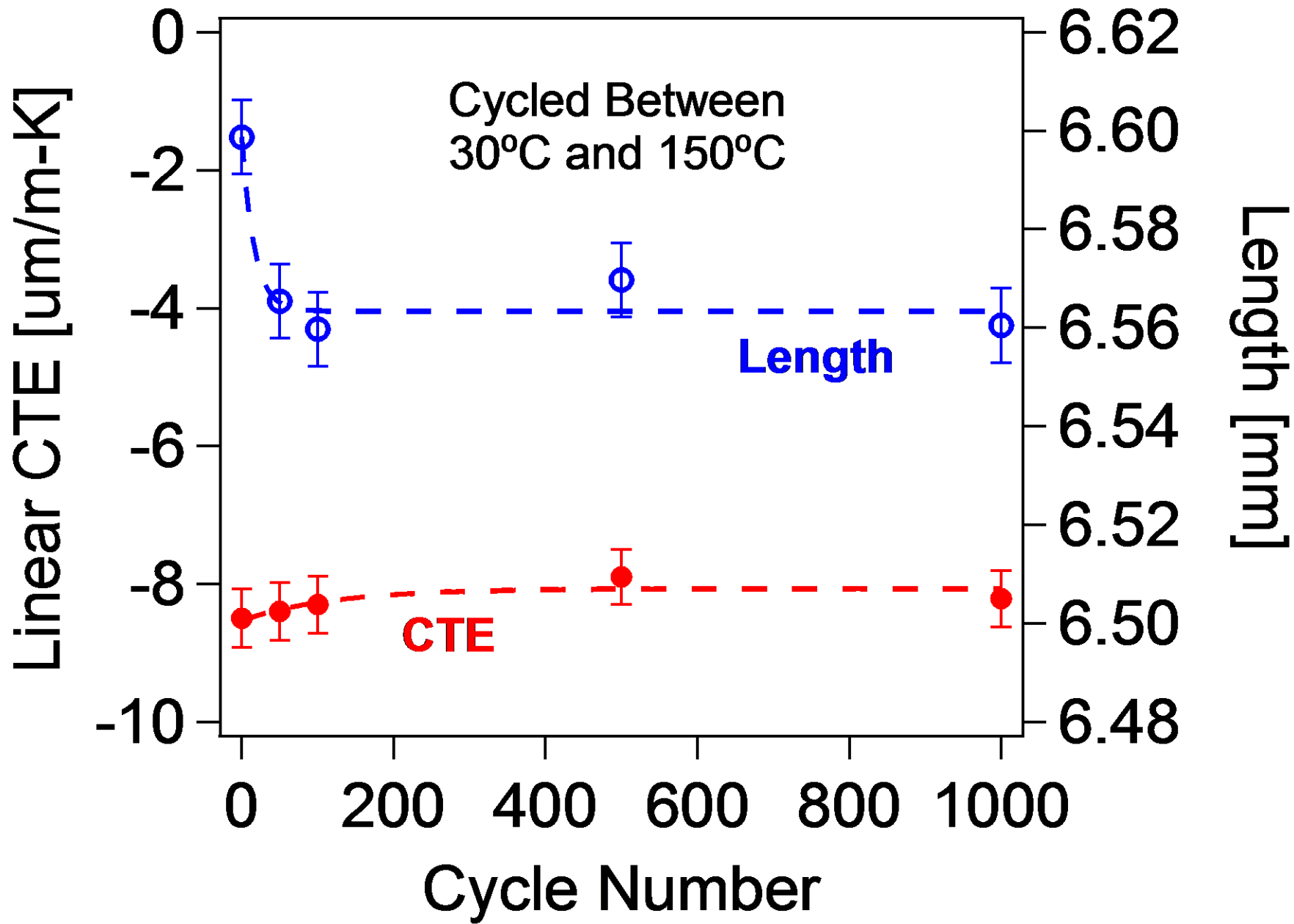


2011
Allvar













ALLVAR

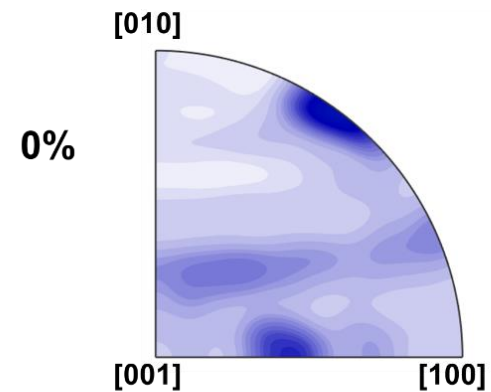
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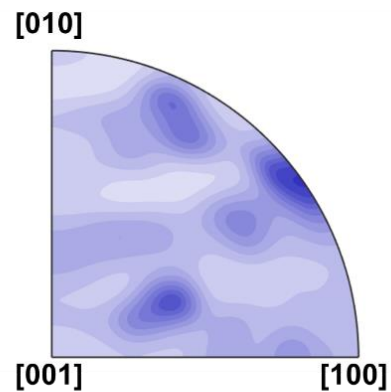
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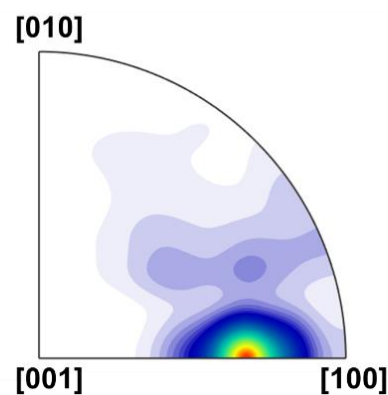
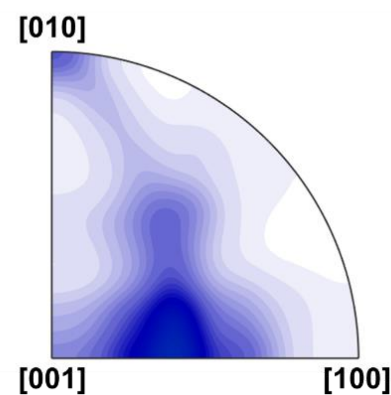
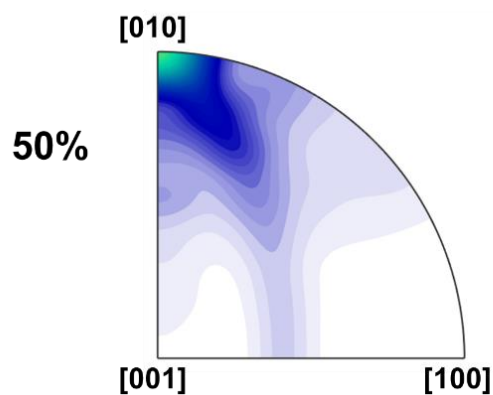
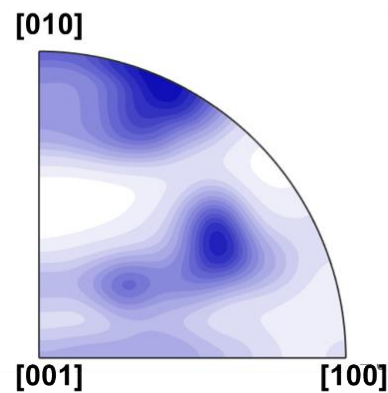
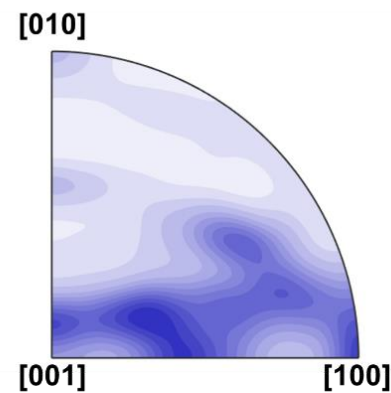
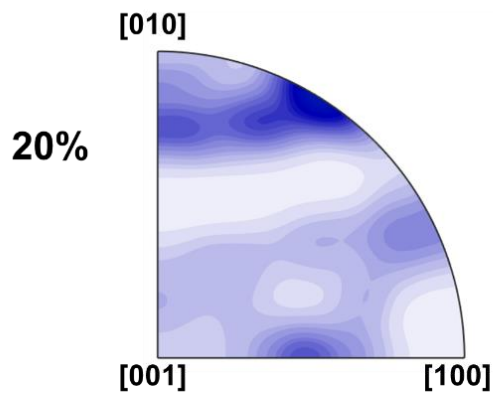
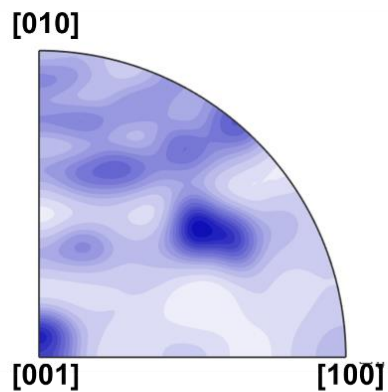
A
Direction



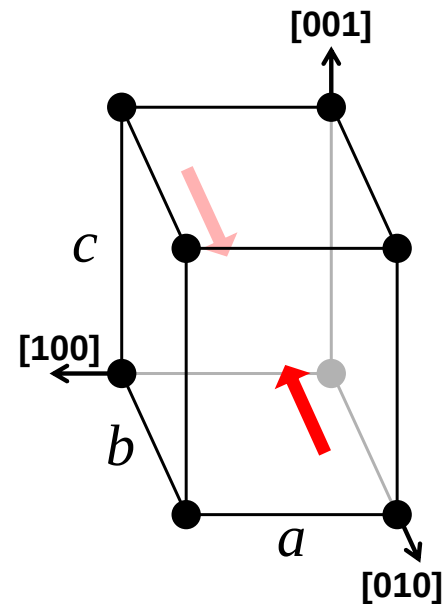
B
Direction



C
Direction



Atomic Scale



Material Scale

