

# Strain Partitioning & Mechanical Stability of Retained Austenite

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## Abstract

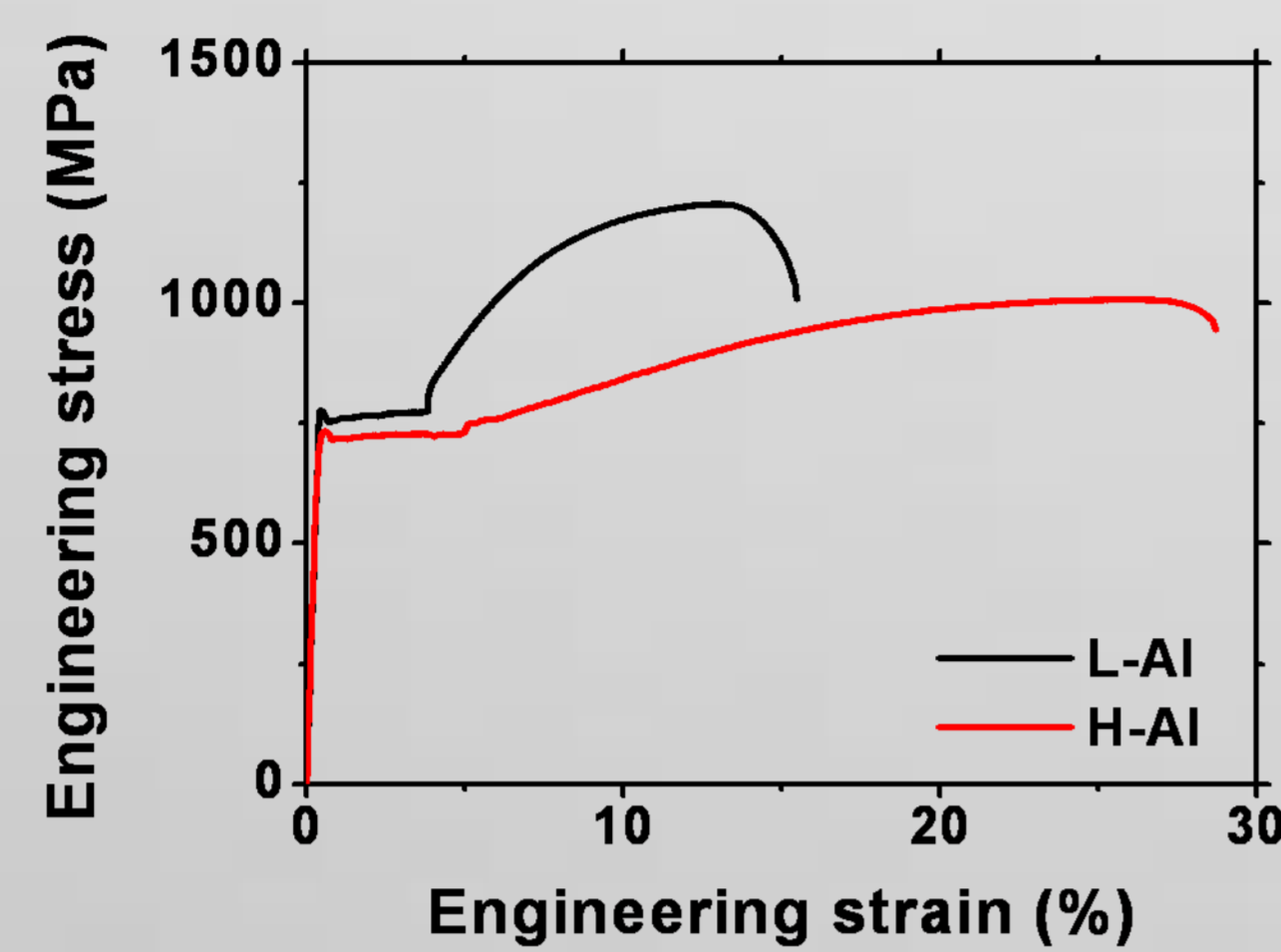
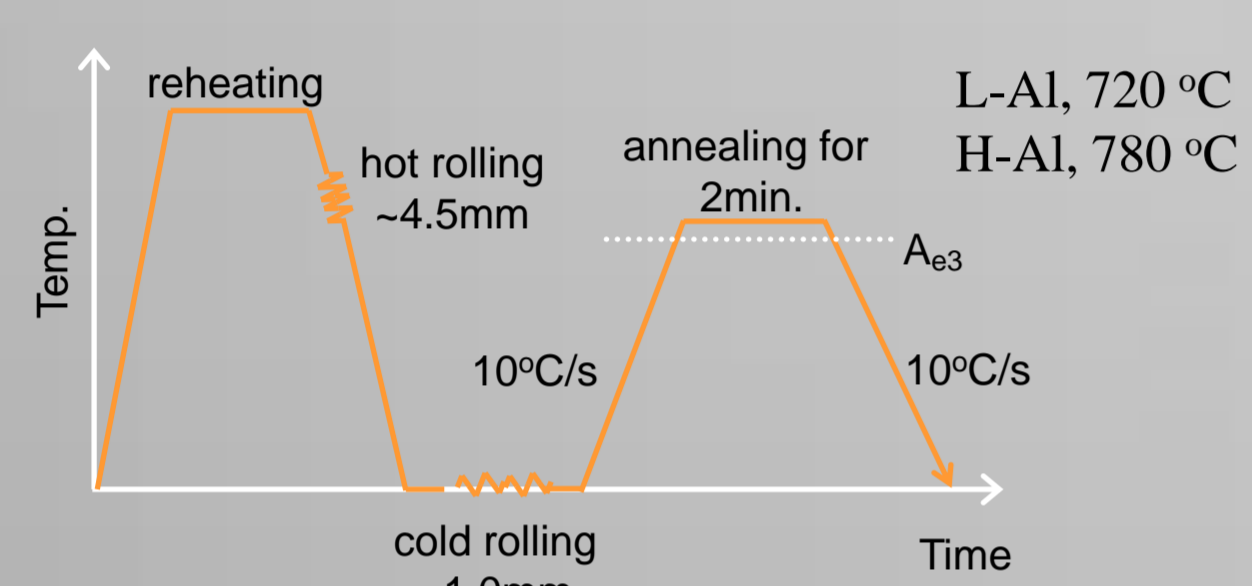
The mechanical stability of austenite in steels which rely on transformation-induced plasticity is usually attributed to its chemical composition, size and shape. We demonstrate here that another factor, the partitioning of strain between phases with different mechanical properties, can dramatically influence the stability.

## Alloys and mechanical behaviors [D. W. Suh *et al.*, Metall. Mater. Trans., 41A (2010) 397.]

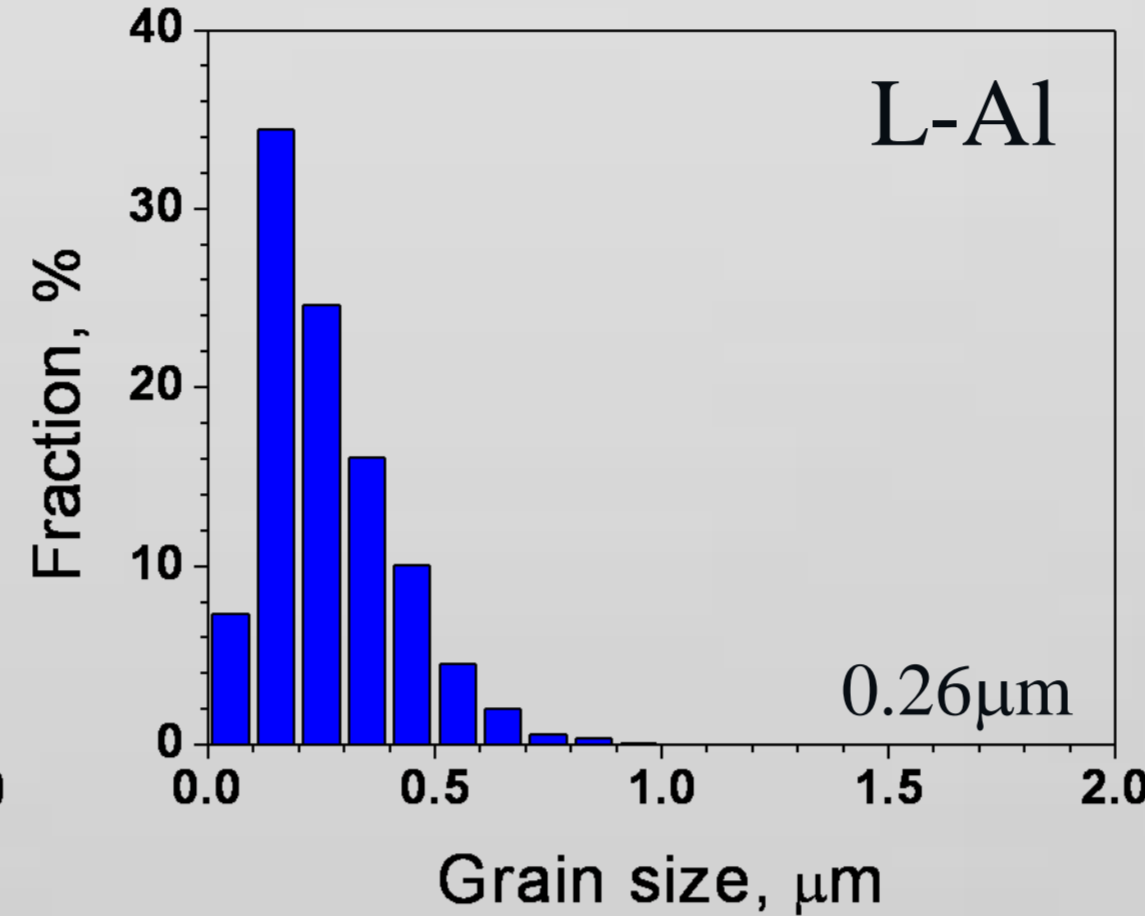
### Chemical compositions

	C	Mn	Si	Al
L-Al	0.12	4.6	0.55	1.1
H-Al	0.12	5.8	0.47	3.1

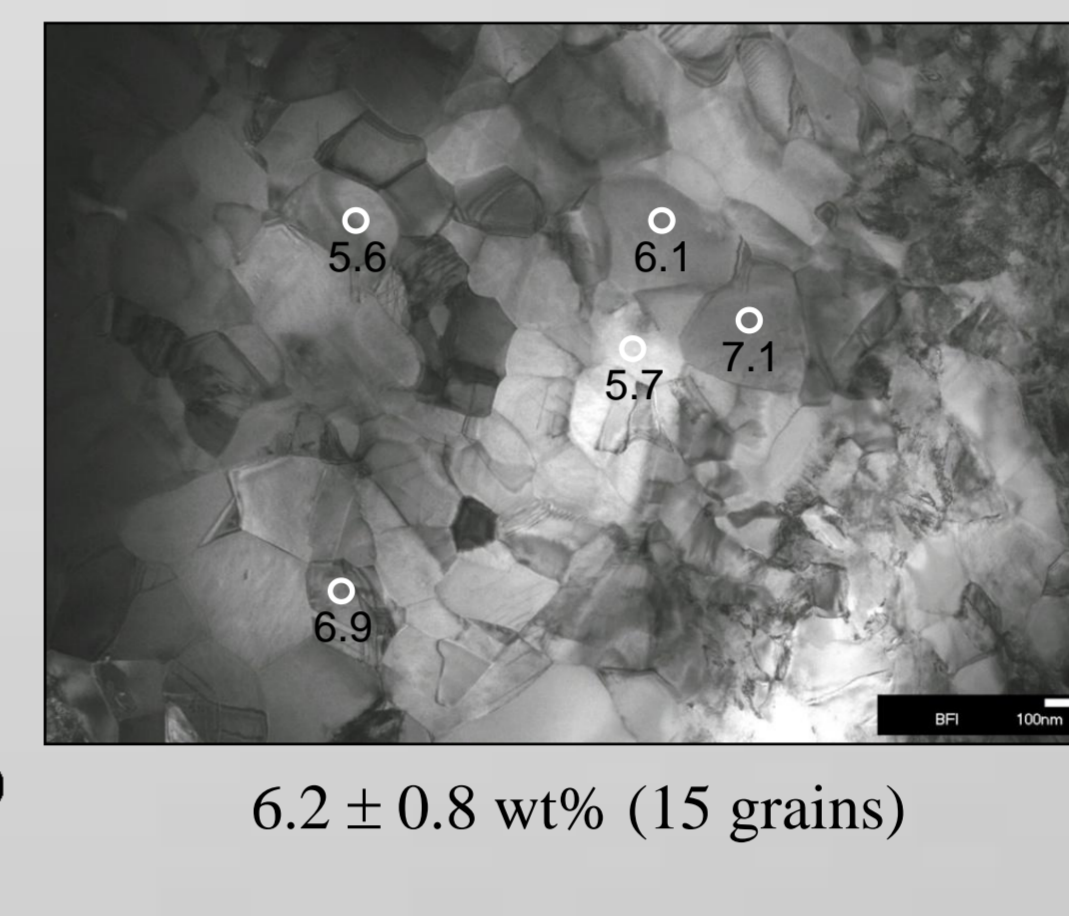
### Heat treatment



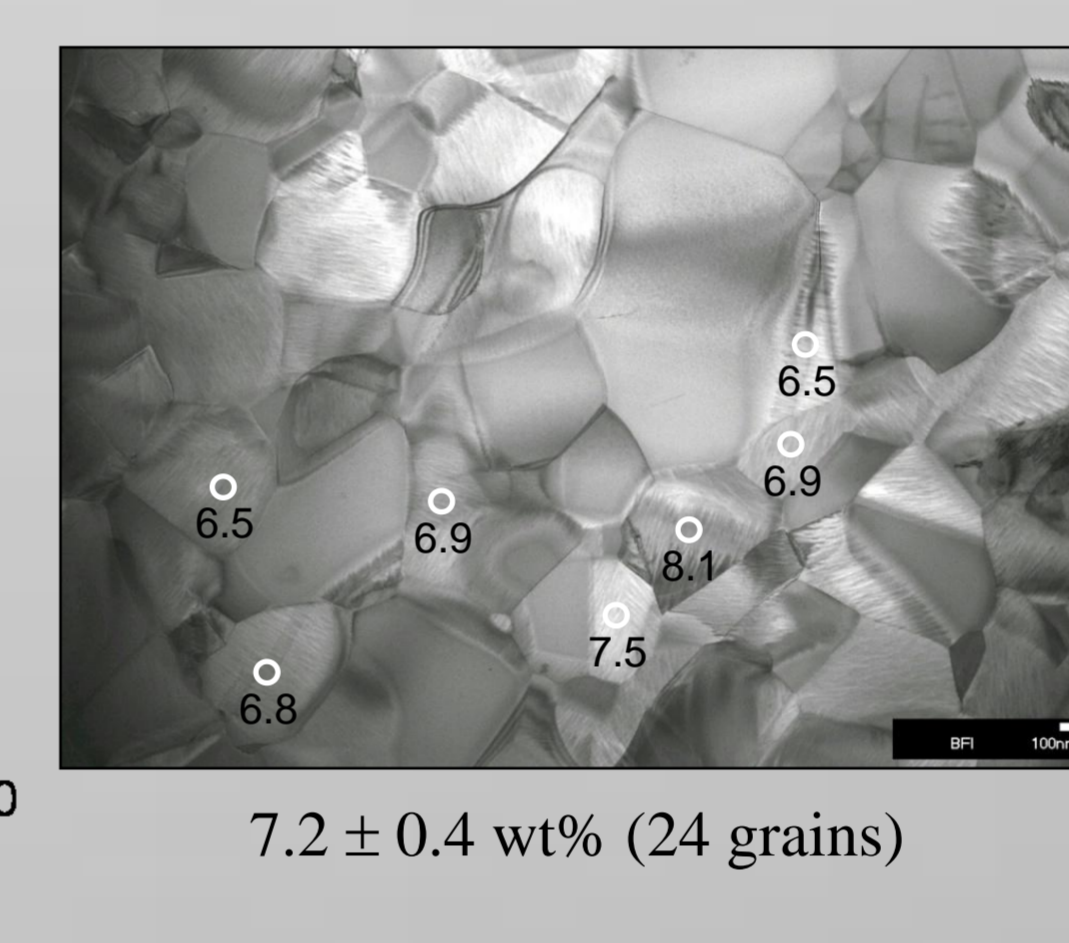
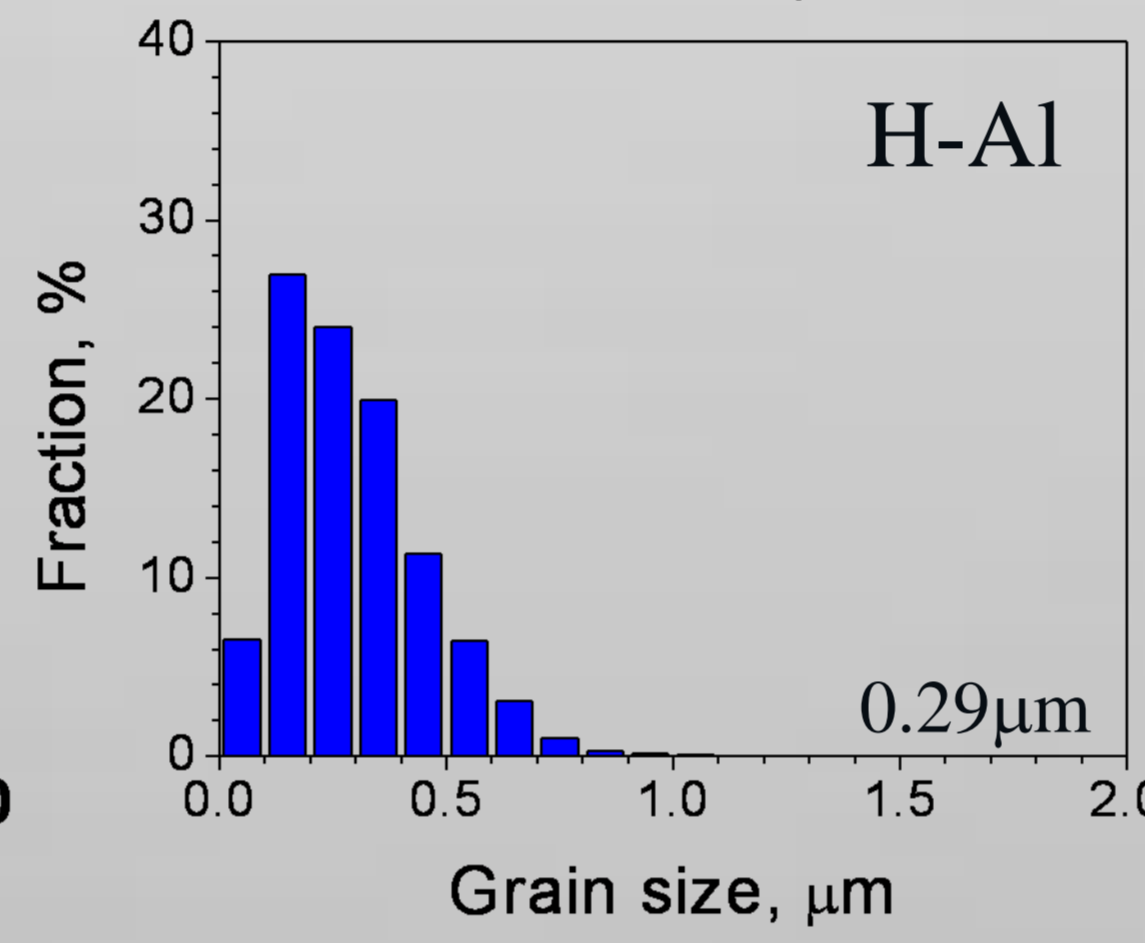
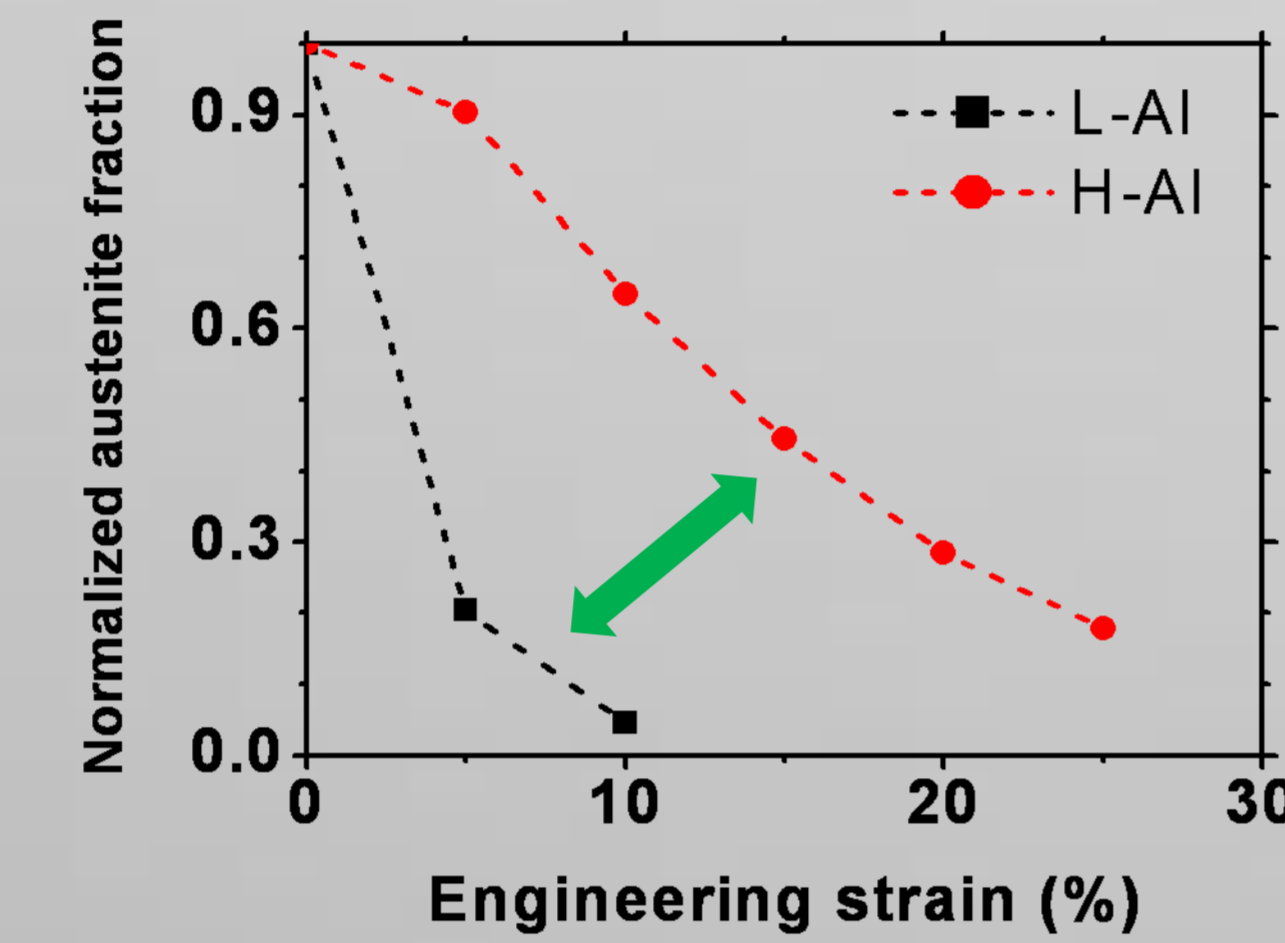
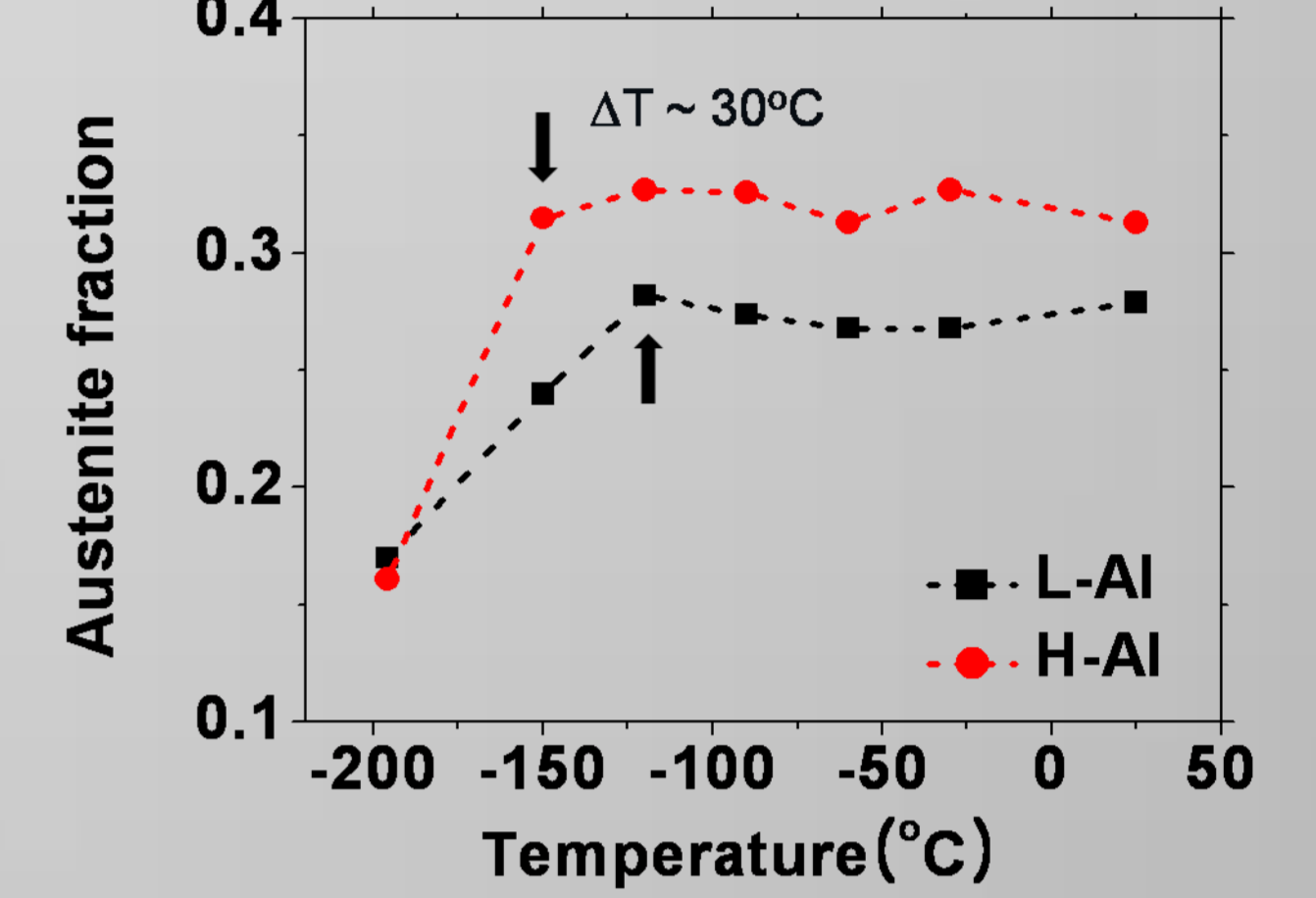
### Grain size of austenite



### Mn content in austenite grains



### Stability – measured with M<sub>s</sub>



### What makes the difference?

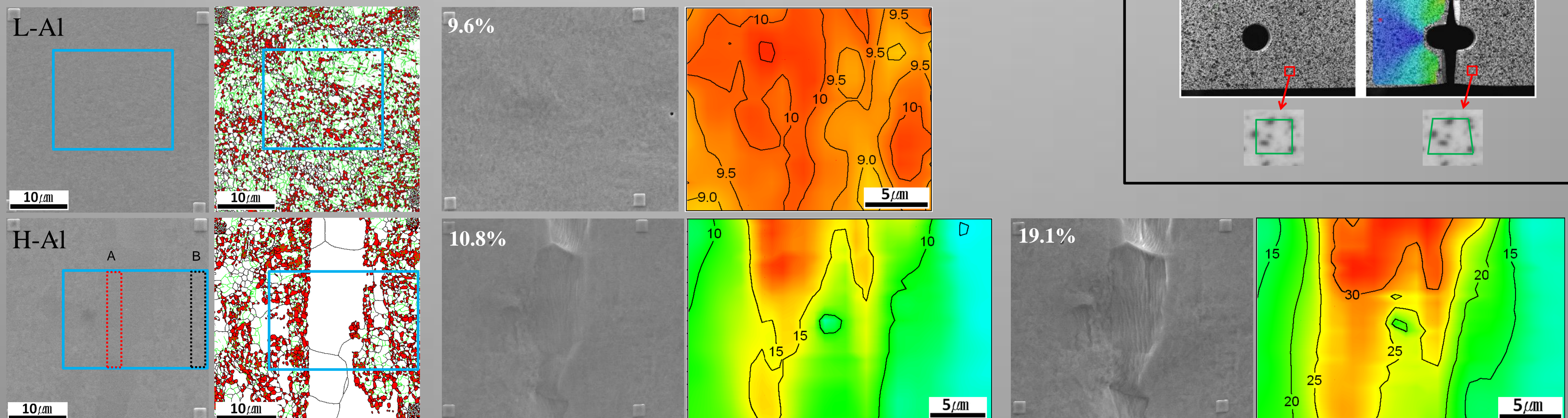
- Size effect : similar grain size
- Chemical effect : difference in Mn content only by 1wt%
- Microstructural effect : strain partitioning

## Experimental method and results

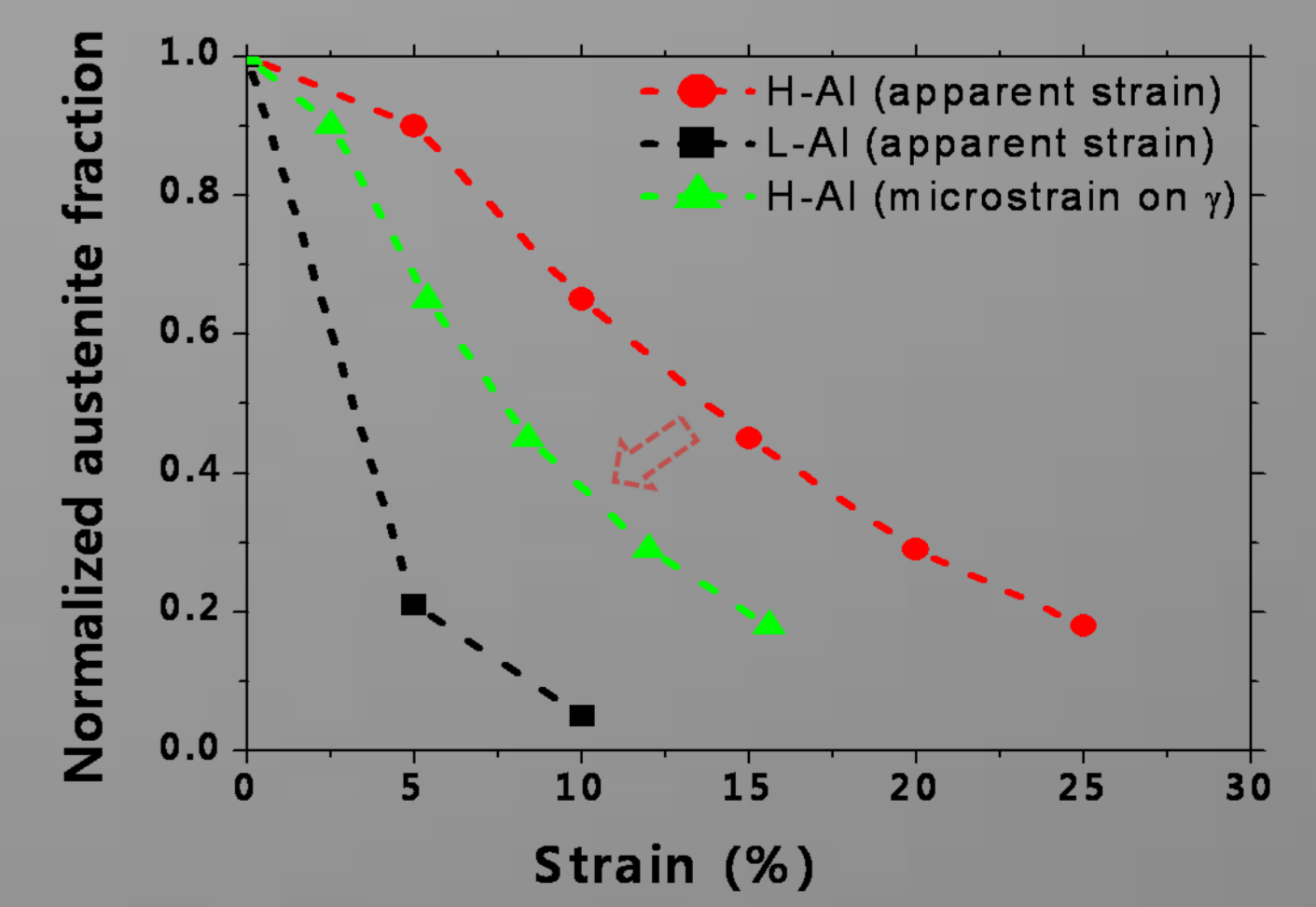
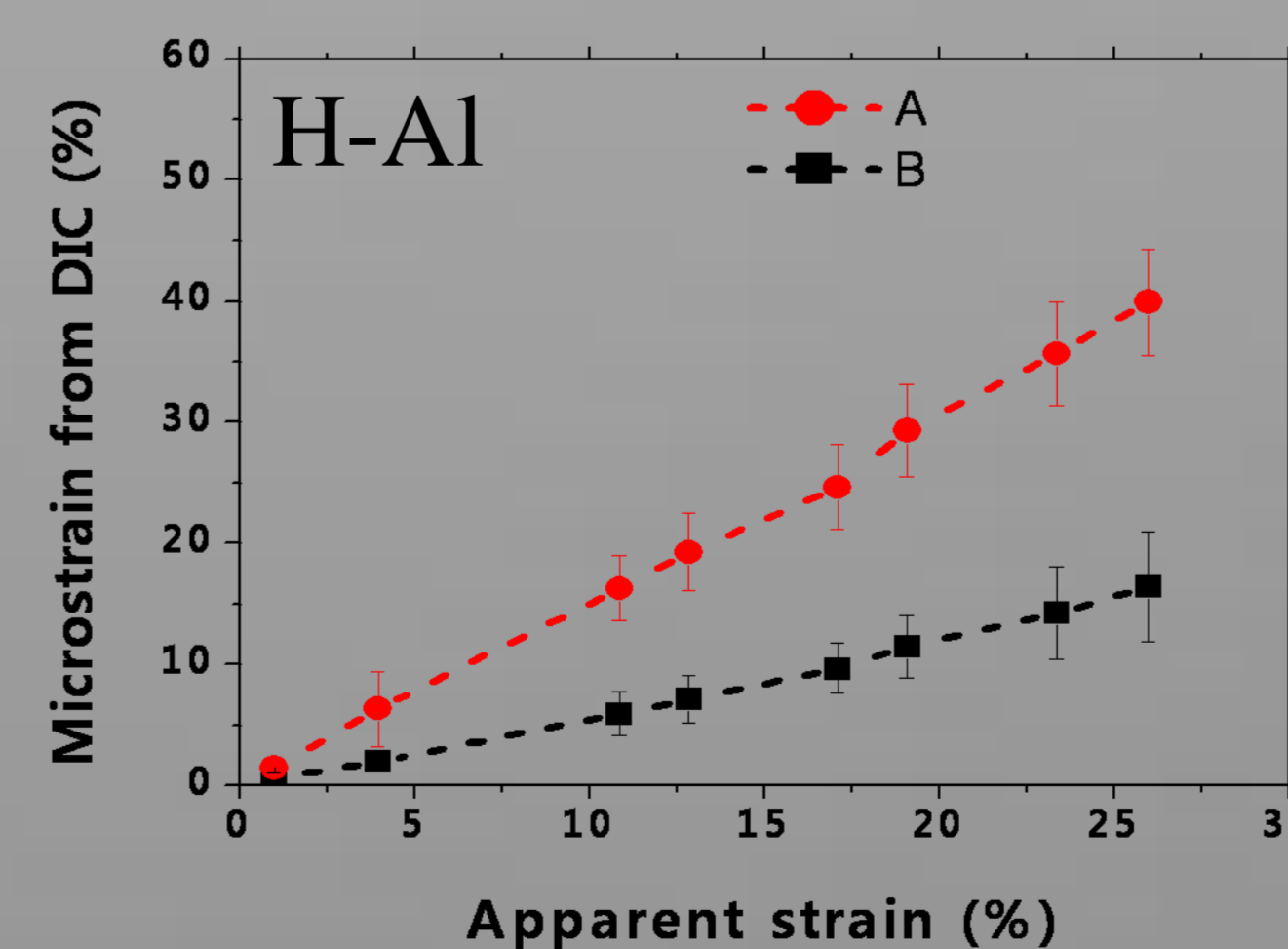
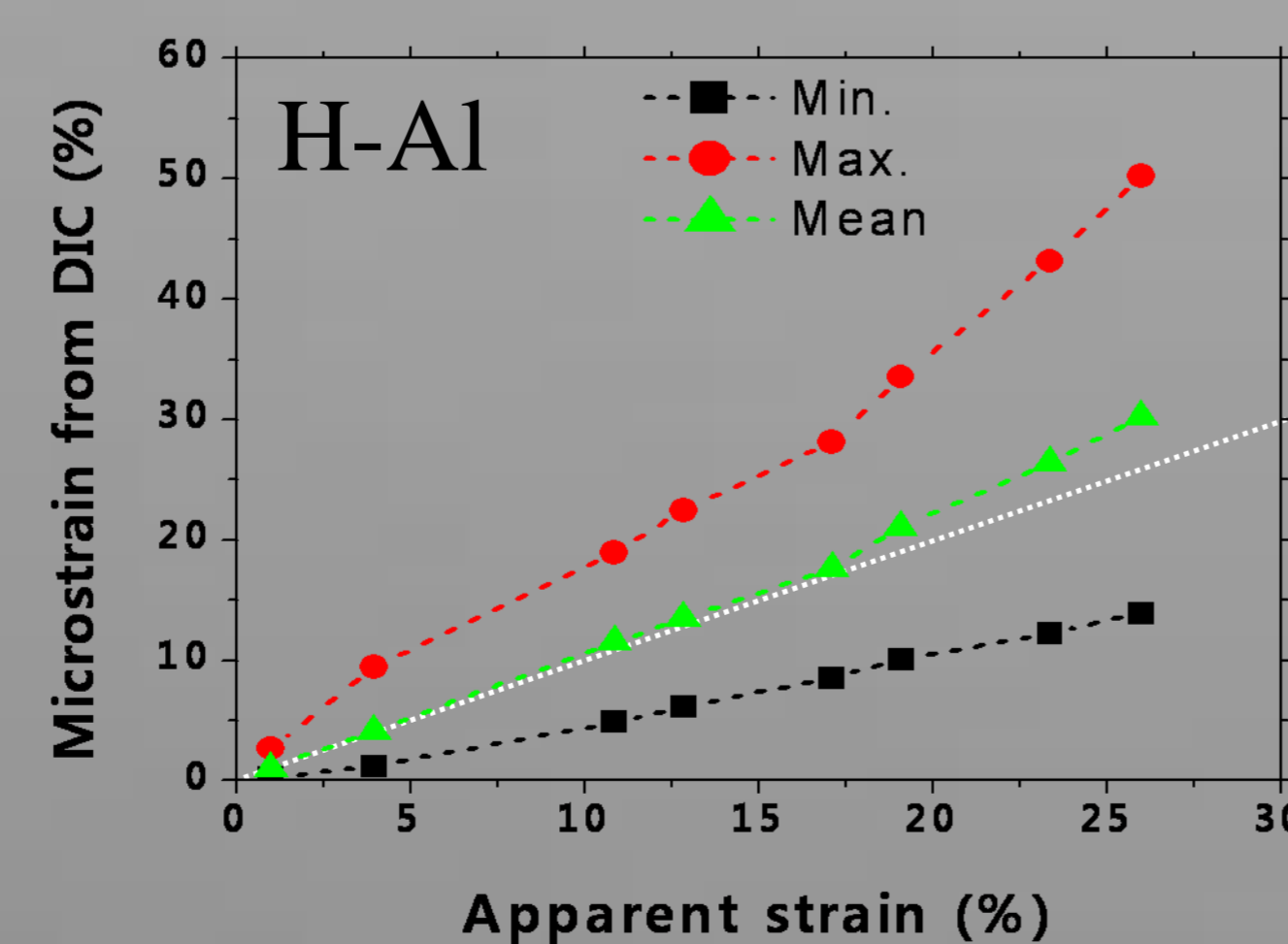
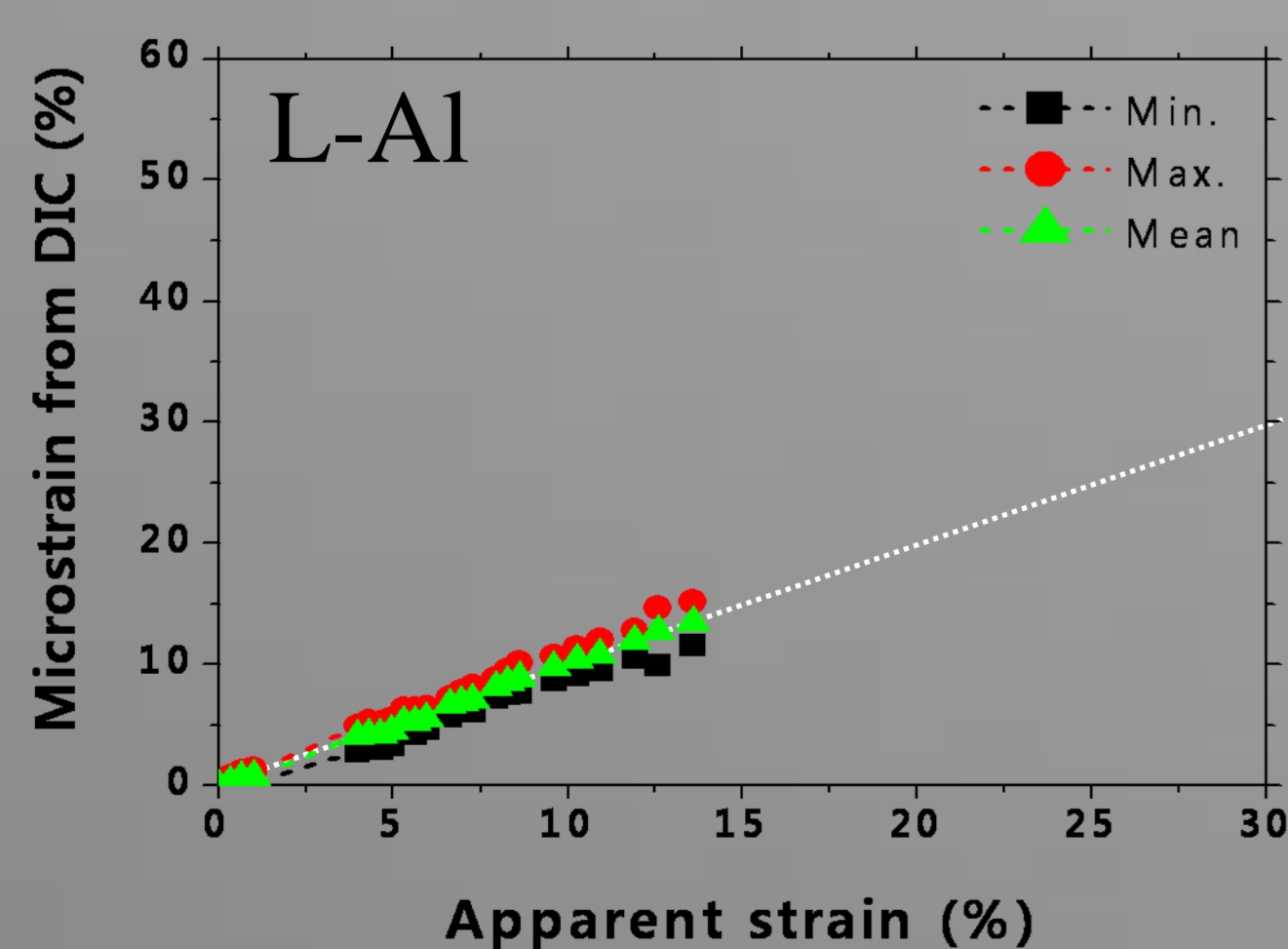
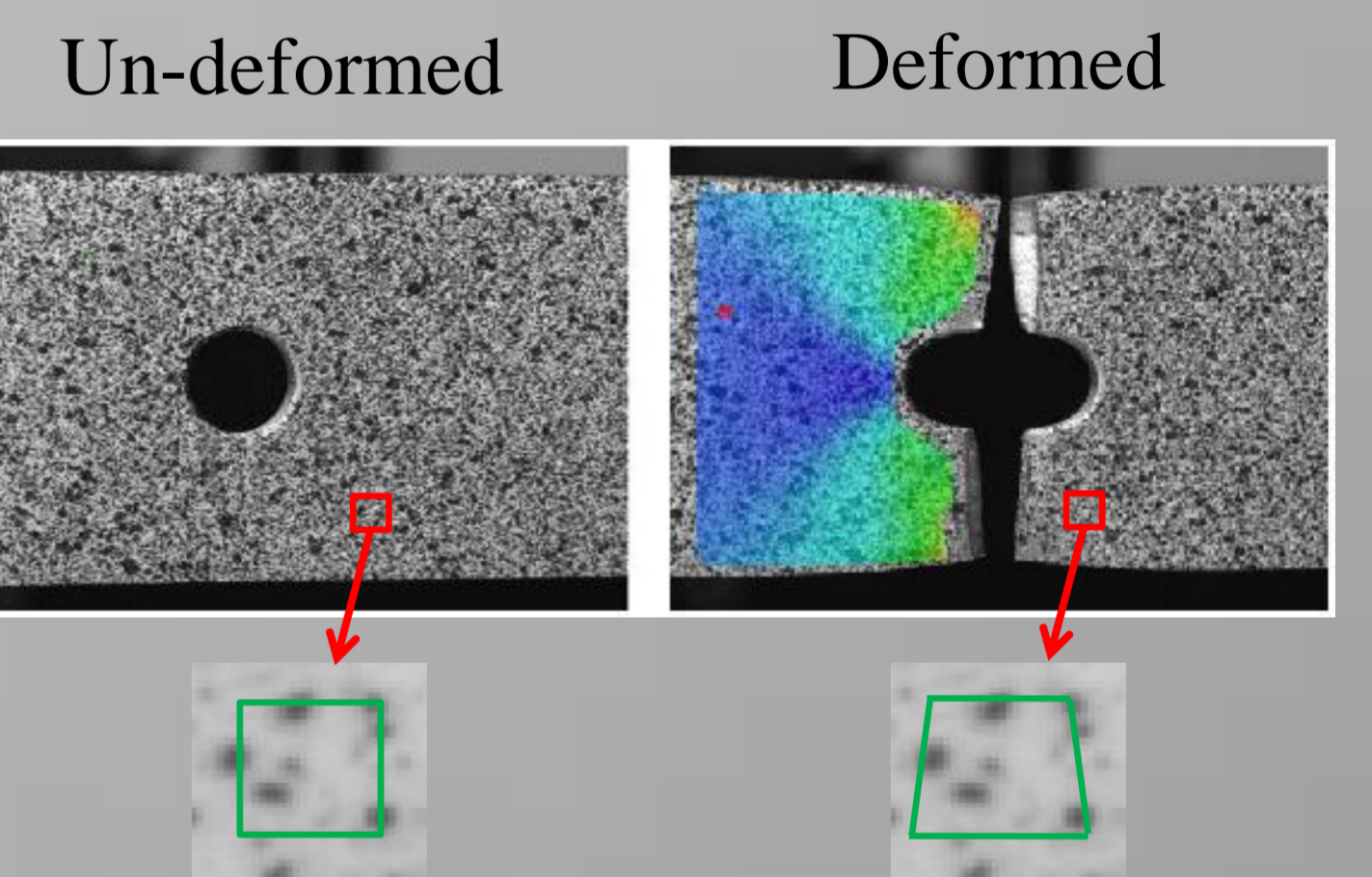
FE-SEM (2000X) equipped with EBSD (70nm) and in situ tensile-test attachment (crosshead speed of 5 μms<sup>-1</sup>)

### Before deformation

### After deformation



### Strain analysis of SEM images with Digital Image Correlation (DIC)



## Conclusion

The partitioning of strain between the different phases present in TRIP-assisted steels can lead to a misleading impression of the mechanical stability of retained austenite when comparisons are made between steels with substantially different microstructures, or when attempts are made to explain the stability in terms of chemical composition alone