Understanding austenite stability in carburised bearing steels

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#1 Introduction

- Austenite is an important consideration for the performance of multi-phase bearing steels.
- Stable retained austenite (RA) improves fatigue life by altering stress states at localised regions and complicating crack propagation paths.
- However, too much austenite promotes significant material expansion leading to geometric distortions.

#2 What affects RA stability?

- **Chemical composition**
- RA morphology
- Neighbouring phases
- **Austenite grain size**
- Grain orientation
- Deformation conditions

#3 Material

Table 1: Composition of steels

Alloy	C	Mn	Si	Cr	Ni	Mo
8AC	1.16	0.81	0.25	0.52	**0.41**	0.20
4AC	1.14	0.54	0.20	0.48	**1.74**	0.20

#4 Microstructure

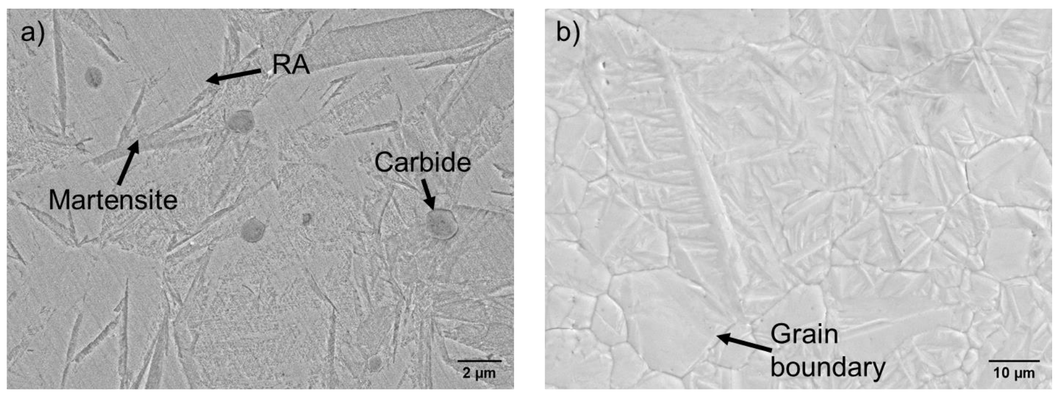

Figure 1: (a) As-carburised ; (b) As-quenched

a) Contains martensite, RA and carbides.
b) Thermal etching reveals prior austenite grain boundaries and a large martensite plate.

#5 Effect of composition

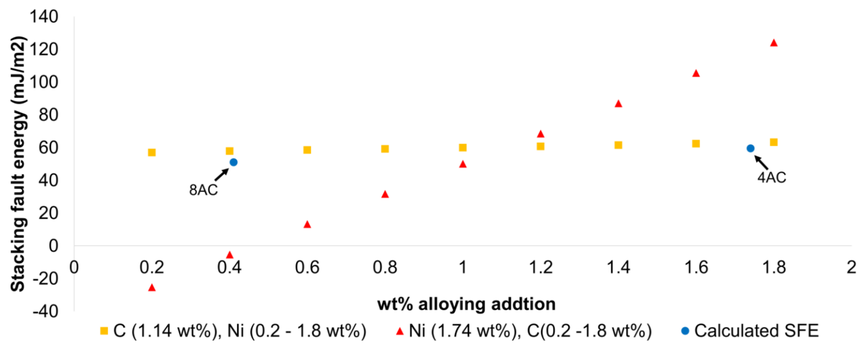

Figure 2: The stacking fault energy increases with higher C and Ni contents, thus increasing RA stability.

- The steeper slope of the red curve implies that C is a more powerful austenite stabilizer than Ni.
- While alloy 8AC has a higher C content than 4AC, the RA stability in 4AC is higher due to a higher Ni content.

#6 Effect of grain size

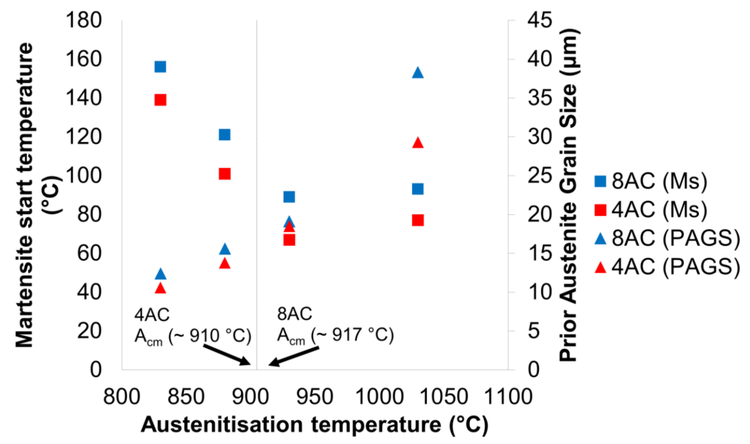

Figure 3: As austenitisation temperature (T_{aus}) increases, the prior austenite grain size (PAGS) increases, but the martensite start temperature (M_s) decreases.

- The initial decrease of M_s with higher PAGS contradicts with reported trends in literature.
- A possible reason is attributed to higher carbide decomposition rates at higher T_{aus}.
- As C partitions into RA, it becomes more stable and suppresses the M_s to lower temperatures.

#7 Conclusions

- The results reveal the effect of C and Ni towards the stacking fault energy of austenite in the steels studied, while M_s and PAGS measurements show conflicting results.
- Preliminary results from the current work can be used to elucidate the influence of chemical composition and austenite grain size towards austenite stability in bearing steels.

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