Fatigue Properties of Aged Mod. 9Cr-1Mo

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1. Introduction

Ferritic/Martensitic steel has a good mechanical properties and a lower thermal expansion coefficient than austenitic stainless steel. Mechanical property of Mod. 9Cr-1Mo steel is less than austenitic stainless steel at high temperature. High temperature mechanical properties are affected by precipitation for Mod. 9Cr-1Mo. FMS steel is used for long time at high temperature and the effect of aging on mechanical properties is very important. In this study, low cycle fatigue properties with aging were investigated.

2. Experimental procedure

Mod. 9Cr-1Mo steel was commercial material of 15 mm thickness. Chemical composition was shown in Table 1.

Table 1. Chemical composition of Mod. 9Cr-1Mo

C	Mn	Cr	Ni	Mo	Nb	V
0.085	0.379	9.37	0.09	0.91	0.08	0.19

LCF tests were conducted at RT-600℃ and strain rate was $2x10^{-3}$/s under strain control. Fatigue specimens was 7 mm diameter and 8mm gauge length. Waveform was triangular and fully reversed. Fatigue life was defined as 25% reduction of tensile peak stress.

All tests were conducted at air environment. Test temperature was maintained constant within ±2℃ during the period of the test.

Mod. 9Cr-1Mo steel was aged at 600℃ during 5000 hr and 10000hr in the vacuum environment.

3. Results

3.1. LCF properties

LCF life was shown in Fig. 1 for as-received steel. LCF life was decreased with temperature. Fatigue strength with cycles was shown in Fig. 2. Fatigue strength was decreased with temperature. Fatigue strength was slightly increased at a few cycles and continuously decreased. The amount of softening was increased with temperature. It is reported that the softening is due to the annihilation of dislocations. The movement of dislocation is easy at high temperature and the softening is severe at 600℃.

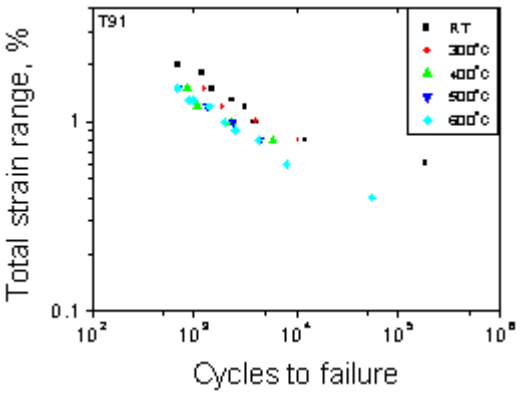


Fig. 1. LCF life of as-received Mod. 9Cr-1Mo.

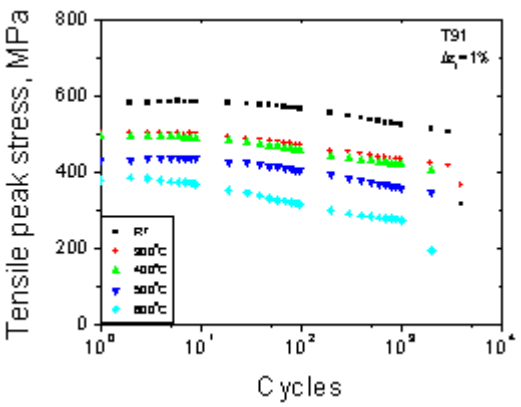


Fig. 2. Fatigue strength of as-received Mod. 9Cr-1Mo

3.2. Effect of aging

LCF life with aging was shown in Fig. 3. LCF life was not decreased with aging at all test temperature. Fatigue strength with aging was shown in Fig. 4. Fatigue strength was slightly decreased with aging. The behavior of fatigue strength was almost same for as-received and

aged steels.

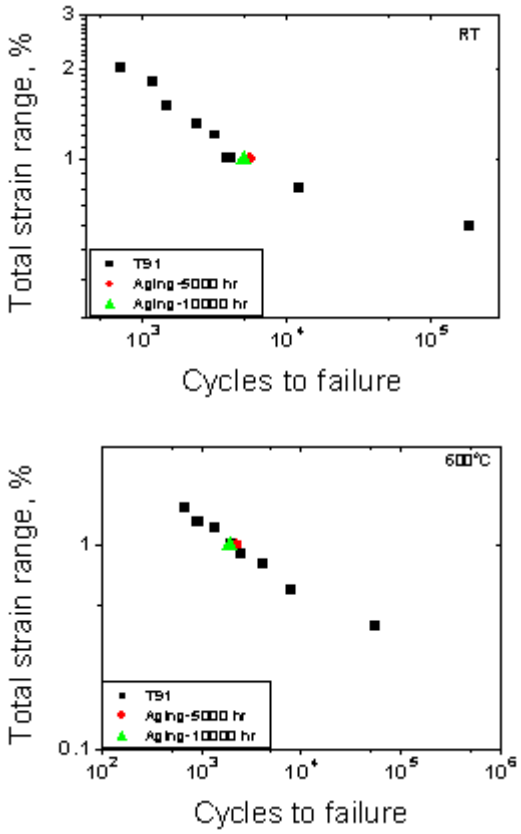
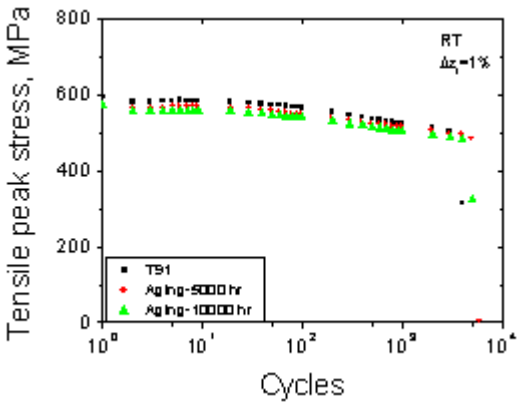


Fig. 3. LCF life with aging.



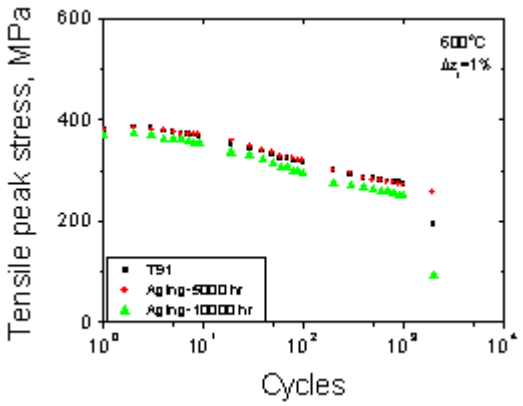


Fig. 4. Fatigue strength with aging.

. 4. Conclusion

Fatigue life and fatigue strength are decreased with temperature. The effect of aging on LCF life and fatigue strength is not great.

Acknowledgement

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