

## Influence of previous deformation on the deleterious phases precipitation in duplex stainless steel UNS S31803

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The modern austenitic-ferritic stainless steels present an interesting combination of high strength and excellent corrosion resistance. A fine grained microstructure composed by equal parts of ferrite and austenite gives the best mechanical and corrosion resistance properties. High temperature solution treatment followed by very fast water cooling is recommended, but not always possible to perform in heavy pieces or constrained structures. The heating or slow cooling in the 1000°C-600°C range promotes the formation of deleterious phases such as chi and sigma [1]. This may happen during welding or hot forming processes.

In the present work the influence of previous cold deformation on the kinetics of precipitation of sigma and chi phases during isothermal aging at 800°C was investigated in an UNS S31803 duplex steel. Two degrees of deformation were applied: 30% and 60%. Figures 1(a) and 1(b) show the comparison of microstructures of specimens aged at 800°C for 5 minutes with and without previous cold rolling with 60% of deformation. Specimens were prepared with electrolytic etching in 10%KOH solution. Dark regions correspond to sigma and chi phases. This etching procedure allows the perfect quantification of deleterious phases by image analysis. Figure 2 shows the variation of the amount of deleterious phases with aging time at 800°C. The results show that chi and sigma phase precipitation are anticipated and intensified by previous cold deformation by rolling.

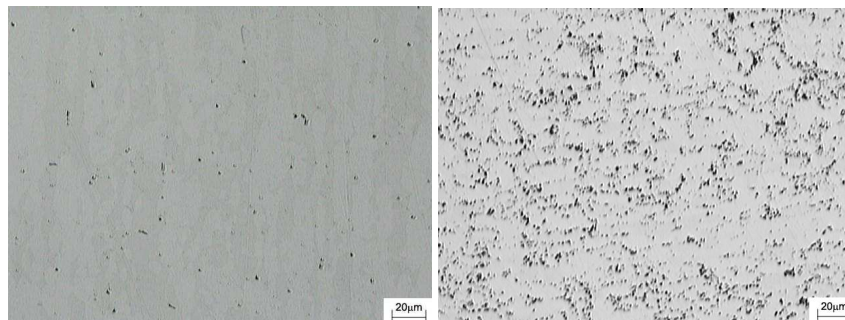


Figure 1: Microstructures of specimens aged at 800°C for 5 minutes: (a) without deformation; (b) deformed 60% before aging.

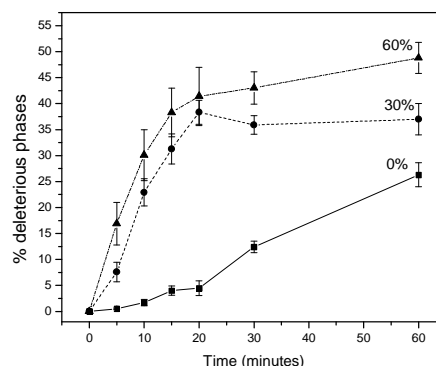


Figure 2: Comparison between the curves of variation of the amount of deleterious phases with aging time at 800°C for specimens un-deformed and cold rolled with reductions 30% and 60%.

### References

[1] ASM Speciality Handbook of Stainless Steels, American Society for Metals, Metals Park, OH 1994.