T73S06 Session 28 Homework – R5V6 (Transition Joints)
Last Update: 8/12/14

Mentor Guide Questions

- Provide written answers to K&S questions 6.1 to 6.9
- Plus, my advice: Read S.J.Heath, J.C.P.Garrett, "Review of Background Information Relevant to Guidelines for Inspection of Transition Welds in AGRs", TD/SEB/MEM/1132/93, April 1993.

Numerical Questions

Carry out an R5V6 assessment to find the life usage at 40 years of the following transition joint and operating conditions:-

- OD and ID are 22mm and 17mm. Assume this applies to both sides of the weld.
- The joint is between annealed 9%Cr1%Mo ferritic parent and 316 austenitic parent, and filled with Inconel weld metal.
- Use creep rupture data from R66 Rev.009.
- There are two operating conditions, one with the joint at temperature 520^{o}C and one at 550^{o}C. Equal times are spent in each condition, and a 520^{o}C-550^{o}C-520^{o}C cycle occurs on average 10 times per year.
- The differential pressure in both operating conditions is 125 Barg.
- Shutdown temperature is 20^{o}C.
- Assume an average load factor of 80%.
- On average there are 10 full depressurisation cycles per year, of which 5 are to cold conditions (20^{o}C) and 5 are to UTJ temperatures not less than 290^{o}C. There are no other load cycles.
- System stresses are to be assumed negligible.
- Assume E = 170 GPa.
- Cross-weld fatigue endurance data is not available. For the parent ferritic material assume the fatigue endurance is as per normalised & tempered 9%Cr1%Mo from R66 Rev.009.
- Assume the mismatch in the coefficient of thermal expansion between the ferritic parent and the inconel weld filler equals 2.5 x 10^{-6} /^{o}C at all temperatures. (Assume that the mismatch between the austenitic parent and the inconel weld also equals this value).
- For the ferritic parent assume the creep ductility for annealed 9%Cr1%Mo parent from R66 Rev.009 Figure 7.12 can be interpreted as implying a lower bound of 10% at the lowest relevant strain rate (ignoring the text of R66 Sect.7.3.1.6(b) for this exercise).

Please use R5V6 Appendix A2 Equs.(A2.1a,b) for the representative stress, even though the alert will notice that R5V6 Appendix A2, §A2.1 actually tells you to use a different representative stress for the stress magnitudes given here (and, in practice, the Mises stress has been used for the assessment of the HYA/HRA UTJs).

3) Did you remember to check that the parent material was not more limiting than the TJ itself? If "no", then do so now.

4) Does the comparison of (2) and (3) give you any concern regarding the data used for the cross-weld rupture?