The Potential Impact of FaME38 on Engineering Science: Case Studies in Optimising Weld Process Control and Life Prediction

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This presentation will outline some of the contributions that FaME has made to engineering problems over the last couple of years, and discuss their potential impact on process control, life prediction, and on advancing the drafting and methodology of codes and standards. It will also indicate several other current areas of innovation and advance based around use of synchrotron and neutron radiation.

The particular case studies to be considered are based around the use of strain scanning, microhardness and metallographic data to improve prediction of process parameters in friction stir welding of 5083 aluminium alloy [1], and to understand how fatigue performance of welds in high strength steels might be made more predictable. The approach is generally to map process conditions (travel speed, heat or energy input, and filler metal strength) across to strain and hardness gradients, microstructure and dynamic performance.

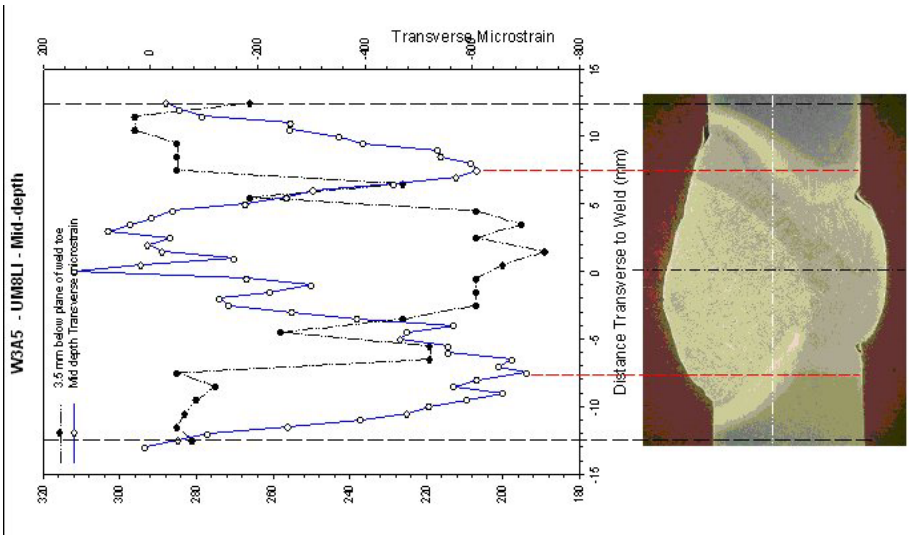

Figure 1: Comparison on a consistent dimensional scale of a weld macrograph, strain and microhardness. Such plots allow interpretation of the underlying reasons for features in the strain profile.

Figure 1 shows typical data format for the case of high strength steel welds. The issue here is to identify whether the relative peaks and gradients of residual strain and hardness, and their relationship with the weld toe position (where cracks nucleate), can be related to the fatigue ranking of the various types of butt weld.

References

[1] – D. G. Hattingh, T. I. van Niekerk, C. Blignault, G. Kruger and M. N. James, Invited Paper (INVITED-2004-01), IIW J. Welding in the World, **48**, No. 1-2, 50, (2004)