Residual stresses in friction welded aeroengine components

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In aeroengine applications the ability to weld components, reliably, reproducibly and with high joint efficiencies, is a key technology. As materials continually improve, the challenges of welding become ever more demanding. Many high temperature alloys cannot be welded reliably using fusion processes. As a result, friction-based solid state welding techniques are becoming the industrially preferred joining methods using inertia friction welding for joining discs/shafts and linear friction welding for joining blades on discs. Since aeroengine materials generally have outstanding high temperature mechanical properties welding can represent a challenge in terms of residual stress generation during joining and stress relief during post weld heat treatment.
Work will be presented
The development of improved engineering neutron diffraction strain scanning beam lines such as SALSA (ILL, France) and ENGIN-X (ISIS, UK) as well as the development of synchrotron high energy dispersive x-ray diffraction have enabled researchers to undertake systematic studies of the residual stress profiles in welds and improve our understanding of how welding parameters and post weld heat treatments affect the residual stress fields and the performance of welded component. The presentation will give examples of residual stress characterisation of inertia and linear friction welds using high energy synchrotron and neutron diffraction. The importance of determining accurately the variation of the stress-free lattice parameter across the weld line will be discussed too.