INITIATION AND FINAL FAILURE VIA ENVIRONMENTALLY ASSISTED CRACKING IN HIGH STRENGTH ALUMINIUM

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Environmentally assisted cracking (EAC) is particularly important to understand and control in high strength aluminium used in engineering applications as moist air provides a suitable environment to assist cracking in these materials. Propagation of EAC has been widely investigated but initiation has been difficult to follow due to it's stochastic nature. We show that time-lapse 3D imaging using X-ray computed tomography offers a way to survey large surface areas whilst maintaining site specific high resolution information giving new insights into this process. In addition the final failure of these materials occurs when the environmentally assisted cracks of intergranular or transgranular type grow to a critical length from the initiation sites. We show through mechanical testing assessment and high resolution fractography that the rapid fracture that follows is also assisted by the environment leading to reduced ductility during the final failure.

Examples from AA5083-H131 and AA7085-T7651 are shown which appear to show the same general behaviour. Round dog bone specimens prepared in the Short Transverse direction were subjected to slow strain rate testing (SSRT) at different strain rates and in different environments. Samples were also pre-exposed to different environments to introduce small corrosion sites to act as 'realistic' stress raisers in the specimens.