Neutron and synchrotron X-ray diffraction for understanding crack tip mechanics
Difracción de rayos X y difracción de neutrones en estudios de fatiga y fractura de materiales

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The fatigue behaviour of polycrystalline metals is often studied through crack propagation analysis [1,2]. Nevertheless, understanding the mechanical processes that take place right at the crack tip [3,4] would also involve considering the deformation developing at the plastic zone and the contact between the crack faces over a portion of the loading cycle [5–7]. Paris law or newer models such as Forman equation are commonly used to interpret growth data [8], but cannot be used to generalise for complex loading scenarios, such as multiaxial loads [9–11] or variable amplitude loads [2]. Diffraction methods are a powerful tool to characterise crack tip strains and stresses [12]. The basics principles of neutron and synchrotron diffraction for measuring bulk properties are discussed [13,14], with special emphasis on grain size effects [15,16], transition between plane stress and plain strain conditions [17], measurement of the plastic zone and development of shielding effects at the crack tip [18].

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