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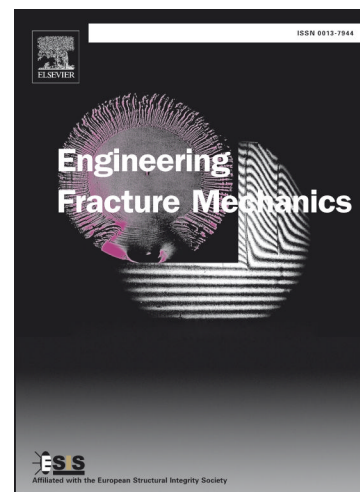
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Crack growth rate of inclined and deflected surface-cracks in round-bar specimens of copper processed by equal channel angular pressing under cyclic loading

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ABSTRACT

For low-cycle fatigued, ultrafine grained copper, processed by equal channel angular pressing, a unique crack growth direction, either inclined at 45° or perpendicular to the loading direction, was observed around the circumference of round bar specimens. In addition, the perpendicular cracks showed a 45° deflected crack face toward the center of the specimens. To clarify the growth behavior of such inclined and deflected cracks, the role of the deformation mode at the crack-tip areas was discussed in terms of the surface damage caused by cyclic stressing and the mixed-mode deformation at the crack tips. The preexistent shear-bands/shear-cracks around the crack tips and the in-plane shear-mode deformation at the crack tips assisted the formation of shallow inclined- and deep deflected-cracks. To quantitatively estimate the severity of mechanical damage at the crack tips, the comparative stress intensity factor range under combined mode I, II and III conditions were calculated. The crack growth rate along the growth direction at the surface and bottom for inclined and deflected surface-cracks was discussed in terms of the comparative stress intensity factor range.

Keywords: Fatigue; Crack growth rate; Stress intensity factor; Mixed mode; Equal channel angular pressing

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