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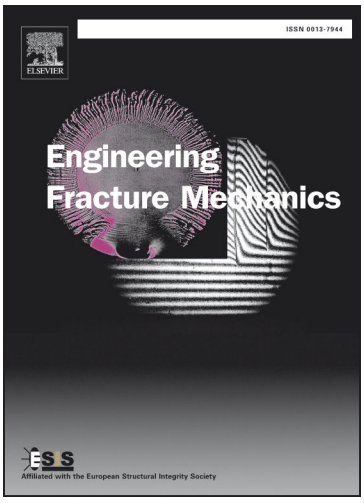

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Study on Mechanical properties and Acoustic Emission Characteristics of Metallic Materials under the action of combined tension and torsion

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Abstract: This study aims to experimentally investigate the tension-torsion failure stress，failure surface direction and acoustic emission(AE) properties for metallic materials under different loading rates. Tension and torsion combination deformation experiments on specimens of carbon steel, cast iron and the aluminum alloy were performed by using Electronic tension and torsion testing machine and acoustic emission signal detection and analysis system. Based on the theory of plane stress state, strength theory and the maximum axial force and the maximum torque collected in the test, the failure stress and failure surface direction of the material under various loading rates were calculated. Based on the least squares method, the multivariate regression model of failure stress and failure surface direction angle with respect to the tension and torsion loading rate was obtained respectively. The research results show that the established regression model for the given metal material can well predict the failure stress and failure surface direction at a given loading rate. The measured values of direction angle of failure surface and its calculated values are in good consistent with the fitted values. Acoustic emission signals of carbon steel in the stages of elastic and yield are more intensive. Both the energy signals of cast iron and

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