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A TWO-SCALE APPROACH TO CHARACTERISATION OF PLASTIC SPIN IN Ti-6Al-4V AT HIGH RATES OF STRAIN

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ABSTRACT

Advanced materials for high performance lightweight structures are, without exceptions, expected to be exploited to their limits albeit just in extreme situations such as those involving impact loading. The ability to predict accurately the response of such materials is crucial in ensuring safe design solutions. In the case of impact loading, the materials are loaded well beyond their elastic limits and the ability to simulate their inelastic behaviour is the required outcome of material characterisation exercises.

In this paper, a two-scale methodology for characterisation of plastic spin is presented. The use of data obtained by means of microscopic material characterisation of samples deformed at high rates of strain is illustrated. A crystal plasticity analysis [1] is employed to provide the link between the experimental data at meso-scale and the material properties required by the macroscopic continuum plasticity model [2] used in design of real engineering components. The ability to simulate the plastic spin is an important pre-requisite to accurate prediction of large deformation [3] leading to damage and ductile fracture in advanced alloys for aerospace applications.

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