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# Formation of shear bands in crushable and irregularly shaped granular materials and the associated microstructural evolution

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## 1. Introduction

Granular materials have a wide spectrum of characteristics and phenomena that distinguish them from liquids and solids. One ubiquitous feature of granular materials is the formation of shear bands. Many geotechnical failures are characterized by bifurcation and spontaneous localization of deformation into rupture zones.

Experimental evidence has shown that the failure of plane strain (PS) specimens always occur along a well-defined shear plane [1-3]. When a specimen is subjected to conventional triaxial compression (CTC), it fails with either a localized shear plane or a bulging shape with no clearly defined shear bands [4]. Shear band formation and evolution also occur in true triaxial tests [5,6], ring shear tests [7], plane strain extension [8], and static and cyclic torsional shear tests [9,10]. These experimental studies have revealed that the shear band formation is influenced by several factors, including the porosity, the inherent and stress-induced anisotropy, the particle size and shape of the material, and the level of confining stress.

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