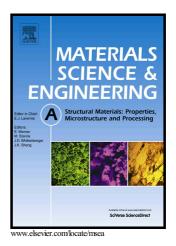
## Author's Accepted Manuscript

Mechanisms of Plastic Deformation in Ultrafine-Grained Aluminium - in-situ and ex-post studies

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## **ACCEPTED MANUSCRIPT**

Mechanisms of Plastic Deformation in Ultrafine-Grained Aluminium - in-situ and ex-post studies

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## Abstract

The microstructure of a 1050 aluminium alloy produced by hydrostatic extrusion varies in terms of grain boundary characteristics and the dislocation substructure depending on the grain orientation. This leads to a variance of plastic deformation mechanisms under external load. In this paper, the microstructure of as-extruded samples was compared to extruded and deformed in a bulk compression test to follow the reaction of various grains to external strain. In-situ TEM straining experiments were performed to study the variance of mobile dislocation activities depending on the local dislocation substructure in as-extruded material to deduce the operative deformation mechanism. These experiments accompanied with a estimation of strengthening mechanisms allowed to explain the role of different grains in the plastic deformation of ultrafine grained aluminium treated as a heterogenous complex system. It is demonstrated that well-developed ultrafine grains are responsible for providing strength since no intergranular dislocation annihilation in boundaries. At the same time, relatively large grains with well developed dislocation

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