19th INTERNATIONAL CONFERENCE ON EXPERIMENTAL MECHANICS

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ICEM•2022
17-21.07.2022 Kraków
POLAND

BOOK OF ABSTRACTS

KRAKÓW, POLAND

17-21 July, 2022

Edited by:
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www.icem19.org

INSTITUTE OF FUNDAMENTAL TECHNOLOGICAL RESEARCH
POLISH ACADEMY OF SCIENCES

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WARSZAWA-KRAKÓW
2022

ISBN 978-83-65550-38-5

Published by
Institute of Fundamental Technological Research
of the Polish Academy of Sciences (IPPT PAN)
5B Pawińskiego St., 02-106 Warszawa, Poland

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Type setting and cover: Dariusz Rudnik

SHEAR BANDING - A KEY MECHANISM CONTROLLING VISCOPLASTIC FLOW. I. DEVELOPMENT OF CONSTITUTIVE RELATIONS

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It was recently shown that two types of shear banding mechanisms control viscoplastic flow in any solids.

- The instantaneous multiscale shear banding system formed by micro-shear bands of the thickness of the order of 0.1 μm, the clusters of micro-shear bands producing the discontinuity of the microscopic velocity field v_m and the macroscopic zone of shear strain localization spreading through the representative volume element (RVE) of a polycrystalline metallic solid. In Pęcherski [1], [2], [4], a new concept of the RVE with strong singularity was introduced, and the instantaneous shear banding contribution function was defined.
- ***The cumulative organization of micro-shear bands*** is based on the accumulation of the particular contribution of micro-shear bands forming clusters in specific volumes contained in RVE. The micro-shear bands gradually contribute to such a case in the development and growth of micro-shear bands clusters. Finally, the clusters accumulate in the macroscopic localization zone spreading across the macroscopic volume of considered material. Such deformation mechanism is observed in the inelastic deformation of gum metals, where the giant faults play the role of elementary micro-shear bands. Also, micro-shear bands play the local shear transformation zones (STZ) in amorphous solids such as glassy metals or polymers. Finally, the phenomenological viscoplasticity model introduces the cumulative shear banding contribution function, Nowak et al. [3] and Pęcherski [4].

Both types of the abovementioned shear banding mechanism often appear with variable contributions during the deformation processes. Such a situation can occur in polycrystalline metallic solids, subjected to the deformation with a distinct change of deformation or loading paths. Also, materials that reveal the hybrid structure characterizing with amorphous, ufg and nanostructural phases are prone to the mixed shear banding responsible for inelastic deformation. Finally, some recent results are discussed and confronted with earlier approaches related to *the instantaneous shear banding contribution function.*

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