Association of Metallurgical Engineers of Serbia
Faculty of Technology and Metallurgy, University of Belgrade
Institute for Technology of Nuclear and Other Mineral Raw Materials
Institute of Chemistry, Technology and Metallurgy
Vinca Institute of Nuclear Sciences
Serbian Foundrymen's Society

MME SEE 2019

Metallurgical & Materials Engineering Congress of South-East Europe

BOOK OF ABSTRACTS

June, 5th - 7th 2019, Belgrade, Serbia
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PREFACE

The Fourth Metallurgical & Materials Engineering Congress of South-East Europe (MME SEE 2019) is a biannual meeting of scientists, professionals, and specialists working in the fields of metallurgical and materials engineering. The aim of the Congress is to present current research results related to processing/structure/property relationships, advances in processing, characterization, and applications of modern materials.

Congress encompasses a wide range of related topics and presents the current views from both academia and industry: Future of metals/materials industry in South-East European countries; Raw materials; New industrial achievements, developments and trends in metals/materials; Ferrous and nonferrous metals production; Metal forming, casting, refractories and powder metallurgy; New and advanced ceramics, polymers and composites; Characterization and structure of materials; Recycling and waste minimization; Corrosion, coating, and protection of materials; Process control and modeling; Nanotechnology; Sustainable development; Welding; Environmental protection; Education; Accreditation & certification.

The Editors hope that Congress will stimulate new ideas and improve the knowledge in the field of metallurgical and materials engineering.

The Congress is organized jointly by the Association of Metallurgical Engineers of Serbia, Faculty of Technology and Metallurgy, University of Belgrade, Institute for Technology of Nuclear and Other Mineral Raw Materials, Institute of Chemistry, Technology and Metallurgy, Vinca Institute of Nuclear Sciences and Serbian Foundrymen's Society.

The Editors would like to thank the Scientific and the Organizing Committee, the Congress Secretariat - CONGREXPO d.o.o. and all those who helped in making the Congress a success.

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Editors

FINITE ELEMENT ANALYSIS OF THE CLEAVAGE FRACTURE IN MEDIUM CARBON V AND TIV MICROALLOYED FORGING STEELS

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Stress and strain distribution at the onset of cleavage fracture during four-point bending testing at liquid nitrogen temperature of two commercial medium-carbon V and TiV microalloyed forging steels, with predominantly acicular ferrite structure, was examined using finite element analysis. The finite element models were based on notched four-point bending Griffiths-Owens's type specimens, while the material mechanical properties data input was based on stress-strain curves obtained by tensile testing at liquid nitrogen temperature. Results of the modeling showed that there were no distinct differences in strain distribution along the distance from the notch tip between the two steel samples, aside from strain magnitude which stems from the differences in stress-strain curves. Based on the recorded load at fracture, the corresponding displacement calculated by finite element analysis was somewhat larger for the V steel. While the TiV steel breaks at cross-head displacement between 0.3 and 0.5 mm, the V steel breaks between 0.6 and 0.9 mm. Plastic strain at the cleavage initiation site for the TiV steel ranges from 0.0595 to 0.1612, while for the V steel these values range from 0.3694 to 0.6338. Observed differences in plastic deformations near the notch root, where cleavage initiation sites were detected, seem to reflect differences in deformation behavior at liquid nitrogen temperature.

Moreover, such difference could be ascribed to the observed differences in structure, primarily in the volume fraction of acicular ferrite. It was concluded that deformations are more uniformly distributed when acicular ferrite is predominant in the structure of the steel. It could be ascribed to the effect of "gradual yielding" related to the high dislocation density in acicular ferrite, somewhat lower yield stress and higher ductility of the TiV steel with predominantly acicular ferrite structure.

Keywords: microalloyed medium carbon steels, acicular ferrite, critical fracture stress, finite element model.

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