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Effect of equal channel angular pressing (ECAP) on structure and properties of the constructional steel St3

Borisova M. Z., Yakovleva S. P., Ivanov A. M.

(Institute of Physical-Technical Problems of the North, Yakutsk 677980, Russia)

The objective of this study was to describe two different ways for performing equal channel angular pressing of the constructional steel St3 and the relation between these two ways and steel's structure and properties. Recent research has focused on the importance of the investigation of how the ECA pressing influences the properties of the plastic metals, such as copper, aluminum and their alloys. However, further investigation of the effect of ECAP on steels is still needed. The investigation was performed with the constructional steel St3 which is widely used under northern conditions, being also the most available material. The billets were pressed by two different ways: Bc (after each pass a billet rotated 90 degrees around its longitudinal axis) and C (after each pass a billet rotated 180 degrees around its longitudinal axis). After two ECAP passes it was found out that grain size decreases from 16－18 μm to 4－6 μm. Difference in pearlite microstructure is displayed after Bc and C paths. At Bc path elongated pearlite's inclusions were obtained, while at C path involute pearlite's inclusions were observed. This difference is caused by different shear directions during second ECAP pass. At －40℃, imitating the northern conditions, results for paths Bc and C were: σ_T=695 MPa, σ_B=705 MPa; σ_T=695 MPa, σ_B=720 MPa, respectively. No significant differences were observed between properties received by paths Bc and C. Therefore, both ways are suitable for practical use. ECAP is a good method of steel processing for its use under northern conditions.

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