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Editorial

Application of Alloys in Transport

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1. Introduction and Scope

Improving the reliability of transport vehicles requires ensuring their durability while reducing metal consumption. The life expectancy of transport systems is established in their design, ensured by sound manufacturing techniques and maintained during their operation, through rehabilitation among other measures. Improvements in vehicles and their environmental performance predetermine the ever-increasing demands on their reliability. The development of new methods for statistically evaluating the cyclic strength of metallic vehicle parts is also significant. These approaches form the basis for the creation of new technologies for the surface treatment of parts, the modification of their properties and their accompanying coating applications. The accuracy of methods for assessing technological impact on fatigue strength—endurance and crack resistance, that is—needs to be improved; this will be achieved by taking into account the microstructural characteristics of materials. The relationship between technological factors in the manufacture and refurbishment of transport equipment parts and performance also requires further attention. The development of reliable methods for predicting the strength and fracture resistance of materials in transport systems has considerable engineering and scientific value, and has been addressed in the current Special Issue.

A selection of articles in the field of "Application Alloys in Transport", are devoted to the creation of new, physically justified calculation methods for assessing the stress–strain state. The development of technological approaches to increase the cyclic strength of metallic materials is also considered; through these analyses we may calculate the life of parts of transport equipment. These articles enable comparative analysis of the efficiency of surface treatment methods that may lengthen the service life of components. The experimental results are described using phenomenological and statistical methods, which ensured their physico-mechanical correctness and statistical significance.

The results are now available, and the Special Issue has been completed. Featuring two reviews and eight full research papers, this Special Issue forms an impressive foundation of knowledge and references for the application of alloys in transport, and covers the practical totality of open issues leading contemporary research at worldwide universities, research centres and industrial companies.

2. Contributions

The first article represents an experimental and analytical study of the potential of the greatest probability method to evaluate the sensitivity thresholds of the bottom and top of the mechanical structural characteristics' statistical distribution [1]. An analysis, based on providing a probability assessment of low-cycle properties of materials extensively

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used in the automotive and aviation industries, is provided; statistical assessment of cyclic elastoplastic strain diagrams and their parameters is taken into account [2,3].

Any additional impulse loads applied to structural material during the main cyclic loading leads to drastic changes in damage accumulation patterns occurring in the surface layers of aluminium alloys. This fact must be taken into account when developing new models for predicting the fatigue life of aluminium alloys for aircraft transport [4]. The influence of factory transport systems (i.e., roller guiding) on the defectiveness of rolled sheet metal has been considered. The physico-mechanical aspects of plastic deformation and formation have a complex distribution on the surface, and are determined by the technology and modes of the material's processing, as well its rate of transportation [5]. Particular attention is paid to the development of new methods for improving fracture resistance in transport systems' materials; limit load solutions of several different pipe-ring geometries, containing two diametric symmetrical cracks with similar depth ratios in a range of $0.45 \leq a/W \leq 0.55$, have been estimated [6]. The ability to estimate crack tolerance in a pipe is very important when examining pipeline transport [6].

Five types of coatings are assessed in terms of their microstructure, hardness, porosity, and wear resistance. The coatings proposed are WC-based (WC-FeCrAl, WC-WB-Co, and WC-NiMoCrFeCo), alloy-based (Co-MoCrSi) or nanoWC coating-based (nanoWC-CoCr). Two tests were performed to assess the wear resistance of the coatings: a dry-pot wear test with two impact angles and an abrasive test using a cloth with two grit sizes. This approach is useful when reconditioning parts of transport systems [7].

Using combined severe plastic deformation (SPD) techniques, a contact wire with an enhanced complex of physical, mechanical and service properties used for high-speed railway lines was produced. This process can be used as an alternative to most conventional production methods, including rolling and drawing. The proposed technique is based on the combination of radial swaging, equal-channel angular pressing and wire-forming [8].

The aforementioned series of papers provides improved accuracy in predicting fatigue strength characteristics, taking into account the influence of surface quality and the nature of its formation. In particular, the relationship between microstructure, surface quality parameters, shape and microstructure depth distribution of the surface layer is taken into account.

3. Conclusions and Outlook

According to the initial spirit of the Special Issue, it is hoped that this collection results in a useful reference tool, complementing and updating previous issues of the journal and forming a solid and reliable basis for further thematic research in the field.

Conflicts of Interest: The authors declare no conflict of interest.

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