Thermal surface treatment of railway wheels surface

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Abstract

Statement of the Problem: The traditional method of regeneration of railway wheels is the correction of the shape of the running surface by reprofiling with the use of semi-automatic lathes adapted to machining and measuring the parameters of railway wheels, because of existing surface damages (Fig. 1). As a result of accidents that took place on the world railways, it was found that the traditional surfacing process including cladding and or remelting is not used for wheel regeneration for safety reasons. Currently, new technologies have become widespread on the market that allow the formation of coatings and new layers on the surfaces of various materials, and above all metal, without any significant influence of heat. One of the possible effective way to create, produce, analyse and optimize new and existing industrial production processes of metal treatment is to develop qualitative and quantitative knowledge helping to understand the mechanisms existing in the mutual relations between wear resistance, hardness, as well as the structure of the of the investigated material.

Here plasma transferred arc was chose for investigation. Based on the performed investigations it was possible to obtain a layer consisting of different zones, with higher properties compared to the base material. As a result of plasma transferred arc treatment, the surface layer can be enriched with the metal particle and in special cases, a high-quality top layer is possible to obtain.

Conclusion & Significance: Concerning original practical implications of this work it was, important to investigate the appliance possibility of cladding for enhancement of the surface properties. The scientific reason was also to describe structure changes and compounds occurred in the laser remelted surface. The main goal of this work was to investigate the microstructure of the thermal treated steel as well as the add metal wire particle distribution in the surface layer of the alloyed and remelted material. Important is also the determination of the thermal treatment parameters, particularly the power, to achieve a high value of layer hardness and wear resistance for protection of the new develop material from losing their properties and to make the wheels surface more resistant to wear. The purpose of this work was also to determine technological and technical conditions for this type of thermal surface treatment.

a) b)

Figure 1 Scratches and small damages along the running surface (a), Flat spots formed by blocking the wheelset by seizure of the axle box, insufficient wagon braking or brake system jamming (b)

Recent publications

1. Gwozdzik M, Kulesza S, Bramowicz M, Bałaga Z (2019) Surface Morphology Analysis of Martensitic Stainless Steel after Different Treatments. Acta Physica Polonica 135/2: 157-161.
2. Konieczny J, Labisz K, Polok-Rubiniec M, Włodarczyk-Fligier A (2016) Influence of aluminium alloy anodizing and casting methods on structure and functional properties. Arch. Metall. Mater 61/3: 1337–1342.
3. Vakkalagadda MRK, Vineesh KP (2024) Causes and failure forms of railway wheels. Materials Today: Proceedings 98: 97–101.
4. Theyssen J, Deppisch T, Pieringer A, Kropp W (2023) On the efficient simulation of pass-by noise signals from railway wheels. Journal of Sound and Vibration 564: 117889.
5. Strey NF, Rezende AB, Miranda R, Fonseca ST, Mei PR, Scndian C (2021) Comparison of rolling contact fatigue damage between railway wheels and twin-disc test specimens, Tribology International 160: 107037.

Photograph

Biography

Associate professor Krzysztof Labisz DSc., Eng. has studied Mechanical and Mechanical Engineering at Faculty of Mechanical Engineering and Technology, Silesian University of Technology, where he also has graduated. His doctor thesis was defended it he field of materials engineering at Silesian University of Technology in 2005. After that he began his professional work as an academic teacher in 2001 at the Silesian University of Technology and has worked there until 2016. From 2016 he worked at the department of Railway Transport, Silesian University of Technology at the Faculty of Transport and Aviation Engineering of Silesian University of Technology, where he works on the application possibilities of engineering materials in the means of transportation

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