

Stereometry specification of damaged working surfaces of the Cu-ETP copper

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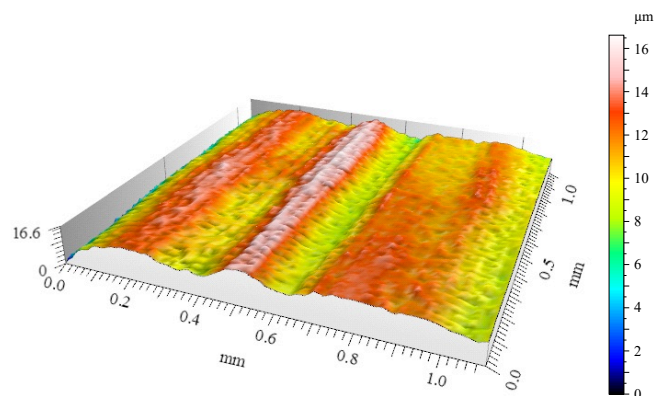
Abstract

Statement of the Problem: This article presents research on the influence of an electric arc, the corrosion effect and result of friction of the current collector on the guide's working surface on the properties and condition of the guide's working surface made of ETP (Electrolytic Tough Pitch) copper in a segment insulator of a railway section. Physical phenomena occurring during the operation of guides, which accompany the passage of the pantograph current collector between adjacent guides, induce many physical phenomena. The impact of an electric arc has a devastating effect on the guide in use and, together with other wear mechanisms such as friction, corrosion and/or oxidation, may in extreme cases cause its complete destruction [1, 2]. The aim of the research was to determine the condition of the surface of the sectional guide used in real conditions. The paper presents the results of testing a guide made of Cu-ETP, in particular the results of macroscopic observations and stereometry specification.

An important parameter characterized by surface quality is its waviness [3]. This feature is defined in the standard [25] as a set of inequalities that constitute a component of the real surface of random or similar character to the periodic form, the intervals of which significantly exceed the intervals of surface roughness.

Waviness usually includes unevenness that has arisen in a manufacturing process, for example, as a result of random tool and workpiece movements. The waviness is a very detrimental feature of the surface as it significantly reduces the possibility of the joint taking up external loads, e.g. in fitted joints, or the surface through which the collector-guide pair transmits the current. On low tolerance, IT is often an unrepairable defect [4].

In the work [5] it was found that analysis of the roughness parameters that characterize the share of the profile material provides information on the geometric structure of the surface. Due to this, it is possible to determine the condition of the surface layer in terms of tribological features.



Conclusion & Significance: Based on the conducted research, it was found that the dominant mechanism destroying the guide is the electric arc and accompanying phenomena such as periodic exposure to high temperature and the associated plasticization of the guide material.

Recent publications

1. Konieczny J., Labisz K. (2023) Wear mechanisms of Cu-ETP guides of Railway traction section insulators. Wydawnictwo Politechniki Śląskiej, Gliwice 2023
2. Konieczny, J. (2021) Destruction mechanisms of Cu-ETP copper guides for sectional insulators of railway traction. Scientific Journal of Silesian University of Technology. Series Transport. 113:101-113
3. Starzyński G (2018) The use of 3D profilometry for surface contact testing, XXIV Seminar on Non-Destructive Materials Testing (in polish), Zakopane, March 14-16. 59-77.
4. Paczyński P (2003) Technical Metrology, WPP, Poznań
5. Matuszewski M (2011) Load capacity of the surface and the type of its treatment, Tribologia, 6: 143-150

Photograph



Biography

Assoc. Prof. Jaroslaw Konieczny 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 in the field of materials engineering at Silesian University of Technology in 2003. After that he began his professional work as an academic teacher in 1998 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 railway transportation.

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