

THE CONCEPT OF CREATING A NEW GENERATION CONTROL SYSTEM

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The aim of the Ukrainian railways to ensure high-speed traffic and increased traction of locomotives requires the modernization of the existing rolling stock and the development of promising systems for improving the economy, energy saving and traction and braking qualities of locomotives.

One of such systems is the sand system, designed to improve the coefficient of traction of wheels with rails and reduce the likelihood of skidding and slipping. The study of sand system designs and their work allowed identifying the main disadvantages that adversely affect the locomotive and track economy, and also negatively affect the ecology [1]. Given these disadvantages, the authors developed, tested and brought to prototypes two promising directions for controlling the traction of wheels with rails [2, 3]:

1 – modernization of the existing sand system, which allows to perform a jet-abrasive action on the rolling surface, while in a pulse form, regulate productivity and, thus, reduce the consumption of abrasive material by 3-7 times, depending on operating conditions;

2 – control of the thermomechanical loading of the local tribological contact, which consists in cleaning and cooling the contacting surfaces with the latest systems - a two-phase flow of dry ice granules and forced cooling with compressed air using a Ranque-Hilsch tube to achieve a stable contact temperature.

Obvious advantages of the second direction, contribute to its increasing distribution, both in the industrial sphere and in the service sector.

Efficiency and intensity of purification by dry ice granules are provided by three effects: *mechanical* – in a compressed air flow, dry ice pellets act on the surface at a speed of about 100 m/s, performing removal of contamination; *thermal* – the heat exchange between the surface and the ice granules causes sharp local cooling and brittleness of the contaminants, causing thermal shock; *sublimational* – through the formed cracks the granules of dry ice penetrate into the layers of contaminants and sublimate in them with more than 400-times expansion, due to a sharp change in the phase state, as a result of which a rarefaction wave forms and a complete separation of the contaminants occurs.

Dry ice cleaning of the surfaces of the wheel and rail from the «third body» has the following advantages: dry ice is an environmentally friendly solid phase of carbon dioxide (CO₂) with a temperature of -79 °C, due to

these unique properties, after heating, it sublimates (evaporates) into the atmosphere, does not require the recycling of secondary waste, dry ice granules are not capable of damaging surfaces that, after sublimation of the granules, remain dry, does not reduce the adhesion coefficient due to water and does not affect the chute electrical equipment and void it. The expediency of using dry ice granules is confirmed by laboratory tests, analysis of fundamental and applied works, which indicates that this method is the most effective for cleaning surfaces covered with oil contamination [4, 5, 6].

Patents for useful models and inventions of Ukraine were obtained by the authors on the developed directions. Scientific and industrial organizations are being searched for joint research, prototyping and participation in grants.

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