INCREASING THE CAPABILITY OF CUTTING ELEMENTS OF EXCAVATORS UNDER OPERATION OF NMMC

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Abstract: *this article discusses the urgent task of reducing the energy intensity of the process of digging soil with stony inclusions in the Navoi Mining and Metallurgical Combine (NMMC), which are noted for high abrasion, gypsum, overdried soils and rocks, which are the technological environment for excavators operating in this region. The article presents an analysis of the design of the cutting organs of the teeth of excavators, tasks and solutions to increase the durability and performance of structural approaches of the cutting organs of excavator buckets.*
Keywords: *abrasive wear, chemical composition, bucket tooth material, bucket tooth resource, steel, excavator, working capacity.*

ПОВЫШЕНИЕ РАБОТОСПОСОБНОСТИ РЕЖУЩИХ ЭЛЕМЕНТОВ ЭКСКАВАТОРОВ В УСЛОВИЯХ ЭКСПЛУАТАЦИИ НГМК

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Аннотация: *в данной статье рассматривается актуальная задача по снижению энергоемкости процесса копанияе грунта с каменистыми включениями в Навоийском горно–металлургическом комбинате (НГМК), которые отмечаются высокой абразивностью, загипсированностью, пересушенностью грунтов и пород, которые являются технологической средой для экскаваторов, эксплуатирующихся в данном регионе. В статье изложен анализ конструкции режущих органов зубьев экскаваторов, задачи и решение повышения долговечности и работоспособности конструкционными подходами режущих органов ковшей экскаваторов.*
Ключевые слова: *абразивное изнашивание, химический состав, материал зубьев ковша, ресурс зубьев ковша, сталь, экскаватор, работоспособность.*

The effectiveness of the functioning of the cutting bodies of earthmoving machines is an urgent task that is used especially in the quarry of Muruntau, which is part of the Navoi Mining and Metallurgical Combine (NMMC). Excavators with a bucket capacity of 5 or more m3 carry out loading of blasted rock mass into vehicles for delivery to further processing. 24 hours a day. Five buckets are installed on buckets of excavators with a bucket capacity of 5 or more m^3. Material of teeth high manganese cast steel 110G13L. The average tooth resource, depending on the strength of the face rocks, ranges from 80-200 hours. After wear of the cutting part (the maximum wear is set within 170 -180 mm) the teeth are removed from the bucket and sent for restoration. The cause of the final culling of the teeth is a breakage or significant wear of their tail parts [1, 2].

The wear of the side surfaces to a noticeable extent occurs only at the cutting part of the tooth. A somewhat different nature of wear is observed in teeth periodically reinstalled during operation. When rearranging, the teeth are rotated 180° relative to their longitudinal axis, due to which both working surfaces of the tooth wear evenly. As a result of repeated reinstallation, worn teeth acquire a streamlined shape with a weakly expressed area of wear. The resource of teeth working in this mode is 1,1 – 1,2 times increased. However, the need for additional labor costs makes this path inefficient. In order to more thoroughly study the nature of wear in laboratory conditions, the chemical composition of the sample material, its microstructure, hardness, details on the surface of the wear site and the presence of hardening were studied.

Chemical analysis of samples of the metal fragment showed the following element contents: carbon – 1,04%; Manganese – 16,7%; chromium – 0,7%; silicon – 0,42%; phosphorus – 0,022%; sulfur – 0,018%; nickel – 0,46%; molybdenum – 0,05%. According to the chemical composition of the studies, the metal of steel 110G13L complies with GOST 2176-77.

Micro - macro and metallographic studies of the working bodies of excavators showed that during their abrasive wear, the main changes that occur with the material from which they are made are reduced to surface deformation due to wear in the form of scratches, tearing and to the formation of surface and deep hardening [3]..

Hadfield Steel 110G13L has been successfully used for more than a hundred years as a material for parts operating under abrasive wear under conditions of high dynamic loaded or pressure. The main ability of Hadfield steel is its ability to intensively harden surface layers (up to 50 HRC) while maintaining a viscous core (1,5-2 mJ / m^2), withstanding shock loads. Steel is alloyed with 11-15% manganese after quenching from 1100° C; its structure consists of 100% austenite. Steel quenching is carried out in order to completely dissolve M3C carbides since carbides and other nonmetallic inclusions reduce the viscosity of austenite. Austenite in Hadfield steel is stable against the formation of martensite strain, and a sharp increase in hardness is a consequence of the deformation structure. In the hardened state, Hadfield steel has a low hardness (20-25 HRC) and the initial plastic deformation of the part is required to “enable” the mechanism of its wear resistance. In the absence of pressure, Hadfield steel has a low abrasive wear resistance [1].

Despite the impact nature of the workloads in the zone of contact between the abrasive particles and the tooth material, only local plastic deformation of the metal takes place, which does not cause deep hardening. It has been established that the high wear rate of the teeth of buckets made of cast steel 110G13L is due to the absence of deep metal hardening on their working surfaces, and the wear rate is ahead of the rate of metal work hardening, the hardness of which is 16-30% lower than the original [3].

At present, extensive experimental material has been accumulated based on research by domestic and foreign scientists, which allows achieving certain results in solving the problem of increasing wear resistance by optimizing the composition and structure of applied structural materials. To further increase the wear resistance of the working bodies of earth-moving machinery, an analysis was conducted of the tribological materials science system “forms - wear-resistant material - operating conditions - wear medium”. He showed that when implementing various research methods, recommendations are made on the chemical composition, physical-mechanical properties, structural phase state, etc., which are significantly different from each other.

At the same time, the wear process covers a set of complex phenomena that occur during various interactions of the surface layers of the metal with the wear medium under certain operating conditions. Therefore, a promising direction in solving the problem of increasing the wear resistance and working capacity of working bodies is the creation of new adaptive and wear-resistant materials, the properties and structures of which can be adjusted depending on the conditions of wear.

Thus, for the confident choice of rational ways to increase the working capacity of working bodies, it is advisable to use the methods of a systematic approach depending on the background of the operation of excavators.

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