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THEORETICAL AND EXPERIMENTAL ESTIMATION OF THE WORKING LIFE OF MACHINE PARTS HARD FACED WITH AUSTENITE-MANGANESE ELECTRODES

TEORETIČNO IN EKSPERIMENTALNO UGOTAVLJANJE ZDRŽLJIVOSTI STROJNIH DELOV, OPLAŠČENIH S TRDIMI AVSTENITNO-MANGANSKIMI ELEKTRODAMI

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We have investigated the possibility of repairing damaged machine parts by hard facing with austenite-manganese steel electrodes. The subject is a Fe-C-Mn alloy with a microstructure of soft austenite which, after cold deformation, transforms by a shearing mechanism into a hard martensite microstructure. These steels are used mainly for parts exposed to high impact loads and intensive abrasive wear. Depending on the degree of wear, these parts can be replaced by new ones or repaired by hard facing. The selection of the optimal reparation technology for the rotational crusher's impact beams is the subject of this study. Investigations of model samples were conducted first, followed by layers hard faced onto samples with austenite manganese and special electrodes. After this the microstructure and hardness of the welds' characteristic zones were investigated. After reparatory hard facing the impact beams were mounted in the crusher and their behaviour was monitored periodically. Both the new and hard-faced beams' behaviours were monitored and compared under the same working conditions. In this way, the optimal technology for hard facing was established, taking into account not only the technical indicators, but also the economic effects.

Keywords: austenite manganese – hadfield steel, mining engineering equipment, hard facing, reparation

Ta članek predstavlja študij možnosti obnove poškodovanih delov z nanašanjem trdih plasti iz avstenitno-manganskih jekel. Predmet raziskave je zlitina Fe-C-Mn z mehko avstenitno mikrostrukturo, ki se med hladno deformacijo s strižnimi mehanizmi pretvori v trdo martenzitno mikrostrukturo. Ta jekla se uporabljajo predvsem za dele, izpostavljene velikim udarnim obremenitvam in močni obrabi. Odvisno od stopnje obrabe se ti deli nadomeščajo z novimi ali pa se obnovijo s trdimi nanosi. V tem delu je preučevana izbira optimalne tehnologije obnove rotacijskih udarnih drobilnikov. Najprej je bila izvršena preiskava na modelnih vzorcih z nanosom trde plasti iz avstenitno-manganske posebne elektrode, nato pa preiskana še mikrostruktura in trdota značilnih varjenih področij. Po obnovi z nanosom trde plasti so bile udarne plošče nameščene v drobilnik in periodično je bilo spremljano njihovo vedenje. Primerjane so bile lastnosti novih in obnovljenih plošč v enakih obratovalnih razmerah. Tako je bila določena optimalna tehnologija obnavljanja delov z upoštevanjem ne samo tehničnih lastnosti, temveč tudi iz ekonomskega stališča.

Ključne besede: avstenitno-mangansko – Hadfield jeklo, rudarska strojna opreme, nanašanje trdih prevlek, obnavljanje

1 INTRODUCTION

In an investigation of the damage caused to various parts of machines and devices it was established that in more than 50 % of cases the damage occurs due to tribological processes involving more-or-less regular working conditions[1–3]. Accordingly, for the design of the reparation technology for damaged parts, we must first study the possible mechanisms of wear for coupled parts. Here, it should be kept in mind that, besides repairing the parts damaged in normal conditions, hard facing is also used for parts damaged due to failures, as well as for new, flawed cast pieces. Besides, new parts are also hard faced by depositing hard alloys, which can replace the traditional procedures of carburizing and nitriding. All these facts indicate that hard facing is an important advanced technologies.

The key parts of machines, assemblies and devices are frequently produced from very expensive alloys. Thus, by repairing them we are not only shortening the down times due to repairs, but also saving on expensive base materials as well as for the machining of parts. In the majority of cases the economic criterion for applying reparation is that the price of the repair cannot exceed the price of the new part. This is especially important for large-sized parts and batch production, while the reparation of unique machines and devices sometimes has to be performed regardless of the price[4–10].