ABSTRACT OF THE DOCTORAL THESIS

Sulfur nitriding technology of steel surface using MoS_2 particles in the atmosphere of NH_3 +H_2S

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The subject of the research described in this thesis was:
1) to develop sulfur nitriding of steel surface using MoS_2 by means of NH_3 +H_2S atmosphere.
2) to check the possibility of additionally improving the functional properties of the new surface layer by introducing powdered dry lubricant in the form of molybdenum disulfide.

An attempt was made to check the feasibility of such a process and whether it is possible to increase the operational durability of steel parts with such a sulfur-nitrided layer. Wear resistance under dry friction conditions was selected as the criterion for assessing the surface layer obtained in the new technological process. The popular heat-tempered steel was chosen as the material for testing, i.e. C45 as well as MoS_2 powder (in the form of flakes with granulation up to 0.85 µm). The following research equipment was used in the research: a Hiden Analytical mass spectrometer for examining gases in the reaction chamber, a Hitachi S-3500N scanning microscope (SEM/EDS), a Siemens D500 X-ray diffractometer equipped with a monochromator, a Sensofar S NEOX profilographometer and a T-05 roller/block type tribotester. Nitriding and sulfur nitriding was carried out in a laboratory, at a research stand for nitriding (resistance-heated tube furnace).

The test results confirm that sulfur nitriding in the NH_3 +1% H_2S atmosphere is feasible and hydrogen sulfide is a good source of sulfur in the process of sulfur nitriding within the ferritic range. Molybdenum disulfide can be introduced into the coating before the sulfur nitriding process, which is a new solution in relation to the current state of the art and has been shown to increase the wear resistance of sulfur nitriding layers. Two new variants of sulfur nitriding and sulfur nitriding technology using MoS_2 were presented in the NH_3 + 1% H_2S atmosphere, leading to improved functional properties of steel elements. The presence of MoS_2 on the treated surface before thermo-chemical treatment probably contributes to the acceleration of H_2S dissociation and the synergy effect (the combined effect of sulfur nitriding and the presence of MoS_2 in the coating was observed) for increased improvement in wear resistance under dry friction conditions.

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