Electronic-plasma processing of the rolled surface for upsetting of metal ware

Abstract
The paper studies the electronic plasma method of the surface processing of rolled stock for cold upsetting in order to remove the scale, surface defects and different impurities.

Keywords: rolled stock, metal ware, surface defects, electronic plasma processing, structure, mechanical properties

Introduction
The competitive advantages of metal ware are formed at all stages of the process chain, which influence on its quality, resource saving and prime cost, with strict adherence to the requirements of production environmental safety. A wide use of metal ware in all branches of mechanical engineering is based on specific characteristics of its use.

The metal ware includes a wide variety of metal goods, as follows: wire, wirework, springs and mounting hardware. The status of the rolled surface has a considerable impact on the quality of metal ware, which is obtained by cold upsetting. However, holding of metal in the course of warming up in the furnace and rolling at the rolling mill leads to forming of scale. It’s further descaling results in decreasing of the usable rolled stock yield and in complicating of its technological treatment.

The technology of surface descaling used in production is the method of etching, which ensures rather a sufficient level of treatment. However in case of using of this type of treatment, there are problems of utilization of spent acid solutions and reducing of the steel plasticity. Etching in the salt bath leads to diffusion of monoatomic hydrogen and a deeper saturation of the surface layers of the hot rolled stock. Further distribution of hydrogen in the wire is defined by the residual stress during pressure treatment procedures, and this has a negative impact at all stages of wire forming.

Mechanical methods of descaling are also used, such as: abrasive powder treatment (shot blasting) and treatment of the surface using monolithic tool. However due to low durability of the drawing tool and increased drawing efforts the assortment of the produced wire is restricted. The durability of the drawing block is lower, than when the etched metal is used and the 100% descaling cannot be ensured. And due to lack of the filling layer, the drawing process is rather challenging.

The application of electronic plasma technologies is an upcoming trend of surface preparation of the rolled stock, which enables to exclude a number of operations, used during etching of metal in acid solutions. At the same time, the safety of the rolled stock surface treatment is increased. This study compared the results of processing using effective treatment technology in pickling fluid and the results of treatment using electronic plasma unit (EPU) of the profiled iron in coils.

It has been established, that there are no traces of scale and decarburized layer on the samples of hot rolled stock, of steels grade 10km, 20, 40X and 51X0A after processing by electronic plasma method. Steels of grade 10km and 20 after being processed using the electronic plasma method correspond to all requirements of the GOST 10702–2016 and may be used in production of the cold upsetting of metal ware. The rolled stock electronic plasma processing cannot be recommended for cold bolts upsetting from steel, grades 40X and 51X0A because of the increased hardness of its surface layer (GOST 10702-2016 and GOST 14959-79) and non-conformance of characteristics of the steel surface 51X0A (GOST14959–79 and GOST 14963–78).

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Conflicts of interest
Author declares that there are no conflicts of interest.

References

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