MedCrave
Step into the World of Research

Material Science & Engineering International Journal

Mini Review

Open Access

CrossMark

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

Special Issue - 2018

PhilippovAA,[1] Pachurin G,[2] Kuzmin N,[2] Mukhina MV,[3] Shevchenko SM,[1]

[1]Candidate of Technical Sciences, Nizhny Novgorod State Technical University, Russia

[2]Doctor of Technical Sciences, Nizhny Novgorod State Technical University, Russia

[3]Candidate of Pedagogical Sciences, Minin Nizhny Novgorod State Pedagogical University, Russia

Correspondence: Pachurin G, Doctor of Technical Sciences, Nizhny Novgorod State Technical University named after R.A. Alekseev, Nizhny Novgorod, Russia, Email pachoringv@mail.ru

Received: April 28, 2018 | **Published:** December 31, 2018

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.[1–4] 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.[5–7] 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,[8] 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.[9] 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,[10] and this has a negative impact at all stages of wire forming.

Mechanical methods of descaling are also used,[11] 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,[12–15] 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 10кп, 20, 40X and 51ХФА after processing by electronic plasma method. Steels of grade 10кп and 20 after being processed using the electronic plasma method correspond to all requirements of the GOST 10702–2016 norms 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 51ХФА 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 51ХФА (GOST14959–79 and GOST 14963–78.

Acknowledgments

None.

Conflicts of interest

Author declares that there are no conflicts of interest.

References

1. Pachurin GV, Filippov AA. Economic preparation of 40X steel for cold upsetting of bolts. *Russian Engineering Research.* 2008;28(7):670–673.
2. Pachurin GV. Ruggedness of structural material and working life of metal components. *Steel in Translation.* 2008;38(3):217–220.
3. Pachurin GV. Role of surface structure in corrosion fatigue of deformed metallic materials. Modern problems of science and education. 2014;1.
4. Pachurin GV. Durability of plasticity of deformed corrosion resistant steels. *Newsletter of Mechanical Engineering.* 2012;7:65–68.
5. Filippov AA, Pachurin GV, Matveyev YuI, et al. Comparison of technological methods of preparation of structural and mechanical properties of rolled stock for upsetting of metal ware in order to reduce the impact of hazardous and toxic factors on personnel. *Fundamental Research.* 2016;10(1):88−96.

6. Filippov AA, Pachurin GV, Kuzmin NA. Reducing of hazardous and toxic factors during treatment of profiled iron. *Modern high-tech technologies.* 2016;2(1):38−43.
7. Filippov AA, Pachurin GV. Resource saving technology for preparation of gauged bars for cold upsetting of profiled rolled stock. *Success of modern Natural Sciences.* 2007;12:139−139.
8. Filippov AA, Pachurin GV, Naumov VI, Kuzmin NA. Low-Cost Treatment of Rolled Products Used to Make Long High-Strength Bolts. *Metallurgist.* 2016;59(9-10):810−815.
9. Filippov AA, Pachurin GV, Kuzmin NA, et al. Comparison of technological methods for preparation of structural and mechanical properties of the rolled stock surface for upsetting of metal ware in order to reduce the impact of hazardous and toxic factors on the personnel. *Fundamental Research.* 2016;10(1):88−96.
10. Poltorastkiy LM, Gromov VYe, Chinokalov VL, et al. Influence of hydrogen on wire plasticity at cold upsetting. Information from higher educational establishments. *Ferrous metallurgy.* 1991;4:56−58.
11. Filippov AA, Pachurin VG, Pachurin GV. Ecological method of rolled stock preparation for bolts production. *Modern problems of science and education.* 2015;1(1).
12. Senokosov YS, Senokosov AY. Plasma born by Mars. *Metal procurement and sales.* 2001;4:50−51.
13. Chinenkov SV, Filippov AA, Pachurin VG. Electronic plasma processing of steel flat and long products 08кп. *Manual: Deformation and destruction of materials and nanomaterials. Materials of the IV-th international conference.* Moscow: IMET RAN, 2011. p. 268−270.
14. Pachurin GV, Shevchenko SM, Mukhina MV, et al. The Factor of Structure and Mechanical Properties in the Production of Critical Fixing Hardware 38XA. *Tribology in Industry.* 2016;38(3):385−391.
15. Pachurin GV, Shevchenko SM, Mukhina MV, et al. Defining rolled metal performance for cold bolt upsetting (bolt head). *IOP Conf. Series: Materials Science and Engineering.* 2018;327.

Citation: Philippov AA, Pachurin G, Kuzmin N, et al. Electronic-plasma processing of the rolled surface for upsetting of metal ware. *Material Sci & Eng.* 2018;2(6):332–333. DOI: 10.15406/mseij.2018.02.00078