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# DIMINISHING FOR MICROPOROSITY OF ROLLING OF STEELS SHKH15(СГ), 45KH9C3 AND 14KH1F

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The defects of sort sticks, made from bearing SHKH 15 and highcarbon (45KH9C3, 14KH1F) marks of steel by rolling on figures 1050/950 and 550 in the conditions of PAJ «Electrometallurgy plant «Dneprospetsstal» are considered. For the decline of defect of «microinterstice» heating of bars of the indicated marks is offered to carry out before rolling at more subzero temperature, that allow practically fully to remove noted defect.

Keywords: bearing and high-carbon steels, heating of bars, rolling, sort stick, microporosity

At drastic conditions developing modern market of different mark steels basic attention is spared to quality of metal production. There is a row of defects, rendering substantial influence on the decline of official characteristics of metal in the process of it exploitation. One of them are microvoids in stick rolling, which curlier [1,2] named internal breaks.

Microvoids (internal breaks) appear during hot deformation in the axial zone of sticks because of its lowered plasticity and presence of stretching tensions. On transversal macrotemplates a defect is darkly-taking poison areas which are situated in an axial zone. On longitudinal micro thin sections there are observed groups of shallow breaks as a net of microvoids, directions of along deformation stretched and being situated in strips, enriched by carbides and segregative admixtures. Formation of such breaks is related to the zonal and dendritic segregation, with enriching of separate areas segregative admixtures (carbidic eutecticum and other phases), having more subzero temperature of consolidation steel of matrix. At the temperature of heating of bars, which exceeds an optimal size for segregative parts, the indicated areas lose plasticity and durability, from what during deformation microporosity appears. Chemical composition of steel, conditions of deformation, degree of dendritic segregation and temperature of heating before deformation, have influence on formation of this defect.

It is known that warning of microporosity formation is possible both by the decline of degree of dendritic segregation in a metal and by the decline of temperature of it heating before deformation.

This work is devoted referred to researches, related to the decline of marriage for sticks of referred steels by their heating before rolling on mills 1050/950 and 550 to more subzero temperature.

At the production of sticks from bearing steel of SHKH15 existing on PAJ «Electrometallurgy plant «Dneprospetsstal» technology foresees heating of bars to the temperature 1230 °C, self-control at this temperature of 1 hour 15 minutes … 2 hours 35 minutes, decline of temperature to 1180 °C and subsequent self-control at this temperature from 1 hour 10 minutes to 4 hour before rolling. During a half-year on a mill 1050/950 a 47 melting (2230 t) of this steel rolling are carried out on sticks by a diameter 150-240 mm. Subsequent ultrasonic quality of sticks control with the use of methods of SEP 1921 showed, that a 11 melting (397 t) steel SHKH15 (СГ) had falls short of to the standard from the presence of echosignals of rejection character. It is set the results of metallography researches, that reason of appearance of indicated echosignals is a presence of microvoids in axial part of hot-rolled sticks.

For diminishing of this type of marriage at heating of bars SHKH15(СГ) steel in the sokers of mill 1050/950 technology, foreseeing the decline of temperature of heating of metal on the second stage on 20 °C, id est from 1180 to 1160 °C is tested. With the use of this technology on a mill 1050/950 rolling of a 54 melting (2560 t) of this steel on sticks by a diameter 150-240 mm is executed. It is set that deformation of bars did not cause difficulties, and plasticity of metal was satisfactory. Thus, the presence of microporosity in four melting (154 t) is educed. Thus, offered regime of heating of bars in the soakers of mill 1050/950, allows to shorten the quantity of marriage on the defect of «microvoids» from 18 to 6 %.

By the decision of problem of removal high level of marriage, fixed at ultrasonic control of sticks from steels 14Х1Ф and 45Х9С3, also it is served the decline of temperature of heating of bars soakers of mill 1050/950 and purveyances in the continuous furnaces of mill 550.

Plant technology of production of sticks from bars 45Х9С3 steel characterized by suffering of metal at a temperature 1270 °C in a flow from 1 hour 45 minutes to 2 hours and its subsequent delivery on rolling. During a year on this technology heating and rolling of 192.65 t 45Х9С3 became is carried out, from them on the defect of «microvoids» did not pass output control of 31.69 i (16.4 %). It is suggested to reduce the temperature of suffering for bars to 1200 °C. On the experienced technology there are exposed to heating and rolling on sticks by diameter 140-155 mm 212.07 t steel 45Х9С3. At ultrasonic control of this rolling internal defects did not discover in a metal.

On the redistribution of steel 14Х1Ф heating of bars on plant technology was executed in the soakers of mill 1050/950 at a temperature 1200 °C during 45 minutes – 1 hour 45 minutes with the subsequent transmission of metal on rolling. On plant tech-nology heating of purveyances from this steel in the continuous furnaces of mill 550 executed at temperatures: 1180 °C is an overhead welding zone; 1200 °C is a bottom wel-ding zone; 1180 °C is a soaking zone. It is set that row of melting 14KH1F (18.45 t) steel fell short of to the standard on the defect of «microvoids», their quantity arrives at 20 % from the rolled metal. It is suggested to carry out heating of bars 14KH1F steel in soakers for a mill 1050/950 at a temperature 1160 °C. Experienced heating of purveyances in the continuous furnaces of mill 550 executed on the next regime: temperature in an overhead welding zone - 1160 °C, in a bottom welding zone - 1180 °C, in a soaking zone - 1160 °C. With the use of this technology of heating on a mill 1050/950 it was rolled 138.74 t sticks from

steel 14Х1Ф by a diameter 140-180 mm and on the mill of 550 – 86.03 t sticks by a diameter 44-125 mm. On the defect of «microvoids» output control was not passed by 15.9 t steel, that was 13 % from the rolled metal.

In connection with the large enough margin of safety of rollers and beds of mills 1050/950 and 550, and also with the insignificant current loading of their electric motors, it was made decision about the further decline of temperature heating of bars 1431Ф steel in the soakers of mill 1050/950 under rolling to 1140 °C, and heating of purveyances of this steel in the continuous furnaces of mill 550 to execute at temperatures: 1130 °C in an overhead welding zone; 1150 °C in a bottom welding zone and 1130 °C in a soaking zone. Rolling of 65.87 t sticks was further executed by a diameter 140-185 mm on a mill 1050/950 and 51.37 t sticks by a diameter 44-125 mm - on a mill 550. By the method of ultrasonic control the presence of cracks in sticks not found out.

*Conclusions.* At the conditions of PAJ «Electrometallurgy plant «Dneprospetsstal» there are worked out and inculcated to technology of heating of bars of steels SHKH15, 45KH9C3 and 14KH1F in the sokers of mill 1050/950 and purveyances 14KH1F steel in the continuous furnaces of mill 550. These technologies allowed substantially to reduce marriage for a metal in the presence of microvoids: on steel of SHKH15 it size diminishes in three times, and on steels 45KH9C3 and 14KHX1FФ - absents practically.

## LIST OF LITERATURE


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