HOT EXTRUSION OF BALLS WITH THE WEAR-RESISTANT LAYER

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Constant improvement and development of new units and mechanisms in the field of automotive industry is associated with increase of bearing loadings in units of the cross-country vehicles, exposed to friction, deterioration and abrasive wear. The requirements claimed to wear-resisting parts are defined by modes of operations as well as character and conditions of their work. In mechanical engineering are widely used and applied parts with a plated layer which is made of rather viscous material. The working part of the abovementioned parts is plated by a material having higher wear-

resisting parameters. Parts of a similar type have higher bearing ability and are capable of withstanding the repeatedly variable impact loadings that increases operating time of units and mechanisms. Thickness of a wear-resisting layer is defined by the sizes of an admissible deterioration and abrasive level.

Parts of complex mould are widely applied in automotive industry. The abovementioned ones have spherical bearing surfaces. The most effective method for manufacturing of spherical bearing surfaces is application of hot dynamic extrusion of the powder porous blank that provides high operating ratio of the metal.

The balls are made of steel by machining of bar on metal-cutting machine tools with the subsequent thermal processing. Manufacturing of parts on traditional technology is rather labour-intensive process, thus in a shaving is lost up to 40 % of metal that affects the cost price of production.

The purpose of syrvey is development of resource-saving technological process of manufacturing balls with the wear-resistant layer located on a spherical bearing surface by reverse hot extrusion of pressings with simple configuration approached to the finished product.

Researches of working surfaces of the balls which have failed as a result of deterioration and abrasive wear have shown that the equatorial part of the working spherical surface is exposed to the most intensive deterioration.

Experimental and theoretical researches as for extrusion of parts with spherical groove (cavity) have been caried out in works. It has been determined that for reduction of non-uniformity of the intense-deformed state and elimination the conditions of formation defects at hot extrusion it is necessary to use porous bimetallic pressing with a facilitating cavity.

Forging of a part have been received from porous pressing with a facilitating cavity. On the basis of calculations as for definition the sizes of a facilitating cavity with the use of program-solver LS-DYNA 971 the optimum angle of inclination of a forming conic facilitating cavity is accepted 36º, and depth is 6 mm. A plated layer of pressing have been made of charge containing 99,4 % of an iron powder of sort PG4M2 GOST 9849-74 (ПЖ4М2 ГОСТ 9849-74) and 0,6 % of pencil lead GK-1 GOST 4404-78 (ГК-1 ГОСТ 4404-78). Porosity of a plated layer made 12%, weight made 163 grams. Plating layer have been made of powder P80X9C2M (П80Х9С2М) obtained from metal and abrasive waste of steel 40X10C2M with porosity of 17 % and weight of 3,54 grams.

Porosity research of obtained forgings on cross-section of a plated layer has shown that different porosity does not exceed 0,5-1 % that meets the operating conditions of the given part as the basic bearing loading is

perceived with a spherical surface, and the walls of the ball serve only directing function.

Directly after extrusion forgnigs have been subjected to heat treatment that is tempering in the chamber of electric furnace in the container with filling by carburizer for prevention of oxidation. Forgings' tempering has been carried out under 400ºC with duration of 1,5 hours and it has been made an air cooling. Heat treatment has not rendered appreciable influence on change of the sizes and quality of surface, wear resistance of a plating layer makes 1,65 nanometers/m.

Forging after heat treatment has been subjected to machining: threading, making chamfers and operational development of the sizes up to a ready detail according to requirements of the drawing.

Conclusion. The technology of balls' manufacturing with wear-resistant layer including the following operations have been developed: manufacturing of pressing with porosity of a plated layer of 12% and a plating one of 17% on hydraulic press with force of 1600 кН model PD-476 (ПД-476), heating in the protectively-regenerative environment up to the temperature of 1100±5ºC, hot reverse extrusion on screw press model F-1730 (Ф-1730) with force of 1000 кН and tempering at temperature of 400°C. Application of the developed technology has allowed to raise wear resistance of a product that leads to increasing operation time up to 34%. The operating ratio of the metal makes 98%.