

Grain Refinement-Plastic Deformation -Texture of Bearing Ring Blank in Cold Ring Rolling

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Short Commentary

Ring rolling is a process for creating seamless ring-shaped components using specialized equipment and forming process because of its technological superiorities of high quality, high efficiency and low consuming in energies and materials [1]. According to the international trend of cooperative control of the geometric accuracy and microstructure performance in ring rolling, rolling forming criteria such as biting-in condition, plastic penetrating condition, and plastic deformation were considered comprehensively to manufacture the bearing rings [2,3]. The evolution rules of grain refinement, plastic damage, and texture of bearing ring in ring rolling compatible with the rolling forming criteria are required for the cooperative control of the geometric accuracy and microstructure performance [4,5].

To realize the cooperative control of the geometric accuracy and microstructure performance of the bearing ring, several rules of the bearing ring formation need to be revealed. Firstly, the constitutive equation of the material used for the bearing ring manufacture is crucial to study the deformation and microstructure evolution of bearings. At present, the high temperature flow stress strain relation, austenite grain growth behaviour, volume fraction and grain size of the recrystallization are still the most important research points for the constitutive equation of the material.

The mechanical conditions of rolling forming and the rules of geometric formation of bearing rings are also important and widely studied such as ring rolling theory [6,7], rolling forming process [8], process tooling [9], and forming equipment [10]. Moreover, many studies revealed the evolution rules of grain refinement, content and stability of retained austenite, and micro texture of bearing rings in ring rolling [11-13]. The effect mechanism of the rolling process parameters on the microstructure evolution and mechanical properties of bearing rings is also established [14,15]. Thirdly, some studies reported how the heat treatment process effects the microstructure evolution and mechanical properties of bearing rings [16,17].

The above research results could hardly provide the optimal rolling technical route to realize the cooperative control of the geometric accuracy and microstructure performance of bearing rings. Further experimental and theoretical studies and numerical calculation may be needed for establishing the quantitative correlation mechanism of rolling technical route with geometric formation, fine crystalline microstructure and high toughness of bearing rings.

Further, it is important to form the cooperative control mechanism of ring rolling process and heat treatment process to obtain the fine crystalline microstructure and high toughness of bearing rings. Future studies should be carried on along the above ideas to solve the optimal ring rolling-heat treatment route realizing the cooperative control of the geometric accuracy and microstructure performance of bearing rings.

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