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ORIGINAL PAPER

Influence of T4 Heat Treatment on Tribological Behavior of Za27 Alloy Under Lubricated Sliding Condition

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Abstract The effects of heat treatment on the microstructure, hardness, tensile properties, and tribological behavior of ZA27 alloy were examined. The alloys were prepared by conventional melting and casting route. The heat treatment of samples included the heating up to 370 °C for 3 or 5 h, quenching in water, and natural aging. Lubricated sliding wear test were conducted on as-cast and heat-treated ZA27 samples using block-on-disc machine. The friction and wear behavior of alloys were tested in contact with steel discs using combinations of three levels of load (10, 30, and 50 N) and three levels of linear sliding speeds (0.26, 0.50, and 1.00 m/s). To determine the wear mechanisms, the worn surfaces of the samples were examined by scanning electron microscopy (SEM). The heat treatment resulted in reduction in the hardness and tensile strength but increase in elongation. The heat-treated alloy samples attained improved tribological behavior over the as-cast ones, under all combinations of sliding speeds and contact loads. The rate of improvement increased with duration of solutionizing process before quenching in water. Obtained tribological results were related to the effects of heat treatment on microstructure changes of alloy.

Keywords ZA27 alloy · Heat treatment · Tribological behavior

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1 Introduction

Improvement of tribomechanical systems, from the aspect of decreasing friction and wear represents an essentially important task. The basic way of solving that task is related to development and improvement of tribological materials. There, the special importance belongs to development of alternative materials in engineering applications in order to reduce the production costs without sacrificing the functional requirements of the components [1, 2].

Zinc–aluminum alloys (ZA alloys) are occupying attention of both researchers and industries, as a promising material for tribological applications. Commercially available ZA alloys (especially ZA27) have become the alternative material, primarily for aluminum cast alloys and bearing bronzes, due to good castability and unique combination of properties [1–12]. They can also be considered as competing materials for cast iron, plastics, and even for steels when being applied for operation under conditions of high mechanical loads and moderate sliding speeds (moderate operation temperatures) [6, 13, 14]. Interest for extending the practical application of these alloys is based on tribological, economical, and ecological reasons. These alloys are relatively cheap and can be processed efficiently with low energy consumption, without endangering the environment [6, 15–17].