

Nano-surface Machining Characteristics of Silicon Nitride

Ceramic for Ball Bearing using ELID grinding

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Abstract

Ceramic ball bearings has been used in high-speed, high-temperature, corrosion, magnetic and vacuum atmospheres due to their low density, high rigidity, and excellent heat resistance and abrasion resistance. The surface roughness (Ra) required for G5 grade ball bearings is 0.014um or less and the shape tolerance is 0.13um or less, which requires high shape tolerance as well as nano-surface. ELID grinding shows excellent performance in creating precise shape tolerances and nano-surfaces. In this study, it has evaluated whether the required surface roughness has satisfied by applying ELID grinding to ceramic materials for ball bearings. The ceramic specimens were prepared by high-temperature and high-pressure sintering at 1700 °C for 2 hours by composition of Y₂O₃ and MgO in Si₃N₄. To evaluate the characteristics of ELID grinding, an electrode has installed in a reciprocal grinding machine to set up the ELID grinding system. Experiments has performed by using a cast iron bonded diamond wheel of mesh number #325, #1200, and #2000, and attaching a 15×28mm size specimen to a rotary table. As the results of the experiments, the surface roughness of the specimens processed with #325, #1200, and #2000 wheels has 0.166um, 0.025um, and 0.003um, respectively. In conclusion, it has confirmed that the surface ground with #2000 wheel is at a level that can satisfy the required surface roughness,



0.014um or less in G5 grade ball bearing.

Figure 1: Micrograph of ELID ground surface

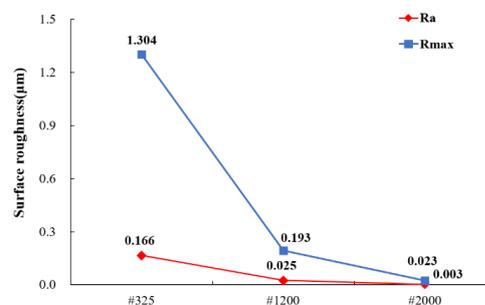


Figure 2: Surface roughness of ground surface