Development of G5 Grade Ceramic Ball Bearing using Magnetic Assited Polishing and Metal Bond Diamond Grinding Wheel

Seung-Min Lee[1], Ha-Neul Kim[2], Jae-Woong Ko[2], Tae-Soo Kwak[1]

[1]School of mechanical and material convergence engineering, Gyeongsang National University and South Korea

[2]Engineering Ceramics Department, Korea Institute of Material Science and South Korea

Corresponding. tskwak@gnu.ac.kr

Abstract

G5 grade ceramic ball bearings are applied to high-tech industrial parts such as aircraft and electric vehicles that require high rigidity, heat resistance, wear resistance, insulation, and light weight. G5 grade ball bearings require a surface roughness (Ra) of less than 0.014um and a shape tolerance of less than 0.13um, and require a high shape tolerance as well as a nano surface. This study aims to secure basic data for the ceramic ball bearing manufacturing process by evaluating whether the required precision is achieved and the material removal rate by applying a metal bind diamond wheel and magnetic polishing to satisfy the nano-surface and shape precision of ceramic ball bearings. Ceramic specimens were fabricated with a diameter of 10 mm by sintering Si3N4 with Y2O3 and MgO at 1700 °C for 2 hours at high temperature and high pressure. A #325 grinding wheel was used for roughing for surface removing of the sintered specimen, and a #2000 grinding wheel was used for shape accuracy and nano surface processing. A container for magnetic assited polishing was designed and manufactured, and the magnetic polishing slurry was tested by mixing cerium, iron powder, and oil in a certain ratio.

As a result of comparing the surface roughness according to the grain size of the grinding wheel, it was found that the processed surface of the #2000 grinding wheel satisfies the required specifications with a surface roughness (Ra) of 0.014um or less. In addition, as a result of comparing the material removal rate when using with a #325 metal bind grinding wheel and the material removal rate by magnetic polishing, the removal rate when using with the grinding wheel was about 10 times higher than the removal rate by magnetic polishing.

Figure 1: Comparison of material removal rate and developed ceramic ball bearing