[G9]

Mechanical properties of Al Alloy (2000, 6000, and 7000 Series) Sintered Parts Fabricated by Powder Metallurgy Process

Tae-Hwan Lim, Young-Sun Kim *, Young-Do Kim
Division of Materials and Chemical Engineering, Sunmoon University, Asan City, 336-708, Korea
Division of Materials Science and Engineering, Hanyang University, Seoul, 133-791, Korea

1. Introduction

The purpose of the present study is to systematically investigate the mechanical properties of optimum 2000, 6000 and 7000 series Al alloy sintered compacts fabricated by a conventional powder metallurgy process, and establish the basis for producing sintered swash plates.

2. Experimental procedures

For mass-production of Al sintered swash plates, 2712 series (containing 10, 20 and 33% ceramic, respectively), 6000 series (201 and 601) and 7775 series (containing 5 and 10% SiC, respectively) powders were used in this study. These powders were compacted into tensile test pieces at a compaction pressure of 2~2.5ton/㎠ (relative density of green compacts: about 92%), and then sintered in a mesh belt furnace for mass-production under nitrogen atmosphere at 600~620℃ for 30~60 minutes. After the resulting sintered compacts were subjected to solid solution treatment and aging treatment, the micro-structure, impurity, tensile strength, elongation, hardness(H_RF), etc. of the sintered compacts were measured.

3. Results

1) Microstructural observation of 10, 20 and 33% ceramic-containing 2712 sintered compacts and 6000 series sintered compacts revealed that all the sintered compacts had a porosity of 4~7%, and more pores were distributed at the surface portion than at the central portion.

2) It was observed that the sintered compacts exhibited higher tensile strength after aging than before aging. For example, the tensile strength of the 10, 20 and 33% ceramic-containing 2712 sintered compacts, and 201 and 601 sintered compacts was 194, 184, 175, 155 and 95 N/㎟ before aging, respectively, whereas the tensile strengths were 269, 262, 257, 233 and 197 N/㎟ after aging, respectively. In particular, the tensile strength of the 10% ceramic-containing 2712 sintered compacts was higher than that of a commercially available 2712 Al sintered part (cam caps) (262 N/㎟). The elongation of the sintered compacts after aging was within the range of 2.5~3.6%. The 10% ceramic -containing 2712 sintered compact reached a maximum elongation of about 3.6%.

3) As for the hardness of the sintered compacts after aging, the ceramic-containing 2712 sintered compacts had a hardness ranging from 94~99, and the 6000 series sintered compacts had a hardness ranging from 77~87. The 20~33% ceramic-containing sintered compacts reached a maximum hardness of 99. The coefficient of friction and wear volume of the five aged Al sintered compacts were examined. As a result, the minimum coefficient of friction (0.63) was shown in the 33% ceramic-containing 2712 sintered compact, and the minimum wear volume (174×10^{-3}㎣) was shown in the 10% ceramic-containing 2712

sintered compact.

4) A sintered compact was fabricated from 7775 powder of the 7000 series, which was reported to show excellent mechanical properties compare to the Al series sintered compacts discussed above. The mechanical properties of the sintered compact fabricated from 7775 powder were compared with those of a commercially available swash plate (cast and forged) before and after aging. As a result, in all cases, the commercially available swash plate exhibited high mechanical properties, e.g., hardness (103), coefficient of friction (0.55) and wear volume (831×10^{-3}㎣). For this reason, SiC powder was added in an amount of 5 and 10% to 7775 powder to fabricate sintered compacts, respectively. As a result of evaluating the wear resistance of the sintered compacts, it was observed that the coefficient of friction of the 5 and 10% SiC-containing sintered compacts was 0.89 and 0.91, respectively, and the wear volume was 162×10^{-3}㎣ and 196×10^{-3}㎣, respectively. From this observation, it could be confirmed that 5 and 10% SiC-containing sintered compacts had excellent wear resistance.