금속재료의 건식 미끄럼마멸 특성에 미치는 가공경화능의 영향

박준기[1] · 유현석[1] · 김용석[1,#]

Correlation between Strain Hardening Capability and the Sliding Wear Characteristics of Metallic Materials

J. K. Park, H. S. Yu, and Y.-S. Kim

Abstract

Correlation between strain hardening capability and the sliding wear characteristics of Fe-C-N alloys with various Cr, Mn, and Mo contents, ultrafine-grained (UFG) Al alloys 1100, 5052 and low carbon ferrite-martensite dual phase steel (Fe-0.15C-0.25Si-1.11Mn-0.06V) were investigated. The Fe-C-N alloys were solution treated at different temperatures (1100°C ~ 1200°C) to have single γ (austenite) microstructure. The Al alloys and the dual-phase steel were processed by an accumulative roll bonding and equal channel angular processing, respectively, to produce the ultrafine-grained microstructure. Pin-on-disk wear tests were performed on the alloys at various applied loads at room temperature, and effects of the varying load and different microstructures of the metallic alloys on the wear were explored. Worn surfaces, their cross sections, and wear debris of the steel were examined by a scanning electron microscopy (SEM). Hardness and strength of the metallic alloys failed to characterize the wear of the steel and the Al alloys. The wear resistance of the ultrafine-grained alloys was not improved with the severe deformation, either. The low wear resistance of the ultrafine-grained alloys was attributed to the lack of strain hardening due to unstable and non-equilibrium grain boundaries of the alloys and the cracking at the interface of the ferrite and martensite phases. Wear resistance of the Fe-C-N steel with superior strain-hardening capability was better than that of the commercial high nitrogen (without carbon) steel, which experienced strain-induced phase transformation during the wear.

Key Words: Strain hardening capability, Sliding Wear, Ultrafine-grained (UFG), Dual Phase Steel, High nitrogen steel

1. 국민대학교 신소재공학부