Microwave Surface Resistance of MgB_2 Films Prepared on *c*-cut Sapphire and MgO

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The microwave surface resistance R_S of MgB_2 films with the zero-resistance temperature of 37 ~ 39 K was measured at 8.0 – 8.5 GHz. The MgB_2 films were prepared by deposition of boron films on *c*-cut sapphire and MgO, respectively, followed by annealing in a vaporized magnesium environment. When the surface of MgB_2 films was ion-milled by ~ 55 nm, the R_S of the ion-milled MgB_2 appeared significantly reduced compared to that of the as-grown MgB_2 films, with the observed R_S of ~ 0.8 mΩ at 24 K for an ion-milled MgB_2 film on *c*-cut sapphire being 1/15 of the value for the corresponding as-grown MgB_2 film. Reduction in the R_S after the surface ion-milling was also observed for MgB_2 films on MgO, with the observed R_S of ~ 2.1 mΩ of the ion-milled MgB_2 on MgO at 24 K being about 1/2 of the value for the corresponding as-grown MgB_2 films. Our results show that effects of the Mg-rich metallic surface layer of MgB_2 films on the R_S were significant regardless of the kinds of substrate used for deposition of MgB_2 films, with the observed high R_S of as-grown MgB_2 films attributed to the existence of the Mg-rich metallic layer at the surfaces of the as-grown MgB_2 films. Dependence of the R_S on deposition conditions is also discussed.

keywords : Microwave surface resistance, MgB_2, Ion-milling