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Reactive sputter deposition of functional oxide films with various performances.Yuzo Shigesato¹, Junjun Jia²¹Aoyama Gakuin University, Sagamihara, Kanagawa, Japan ²Aoyama Gakuin University, Sagamihara, Japan

yuzosige@he.netyou.jp

Reactive sputtering using alloy targets should be one of the most promising techniques to achieve very high deposition rate for various industrial applications because sputtering yield of the metallic surface is much larger than that of the oxide surface and also the higher sputtering power density can be applied for metallic targets with the higher thermal conductivity. The reactive sputtering process, however, is strongly affected by the O₂ flow ratio; the deposition rate exhibits hysteresis with respect to the O₂ reactive gas flow rate. Such behavior originates in the oxidation state of the target surface, resulting in the marked decrease in deposition rate with the increasing O₂ flow. Therefore, the sputtering conditions should be precisely controlled so as to obtain high-quality transparent conductive oxide (TCO) films by reactive sputtering processes with a high deposition rate and with high reproducibility. In order for the precisely controlled deposition a specially designed feedback systems of discharge impedance or plasma emission intensity combined with mid-frequency pulsing were adopted. In this presentation, the very high rate deposition of various TCOs, such as Al-doped ZnO (AZO), Sn-doped In₂O₃ (ITO), Nb-doped TiO₂ (NTO), or Sb(Ta)-doped SnO₂ (ATO, TTO) films by reactive sputtering using Zn-Al, In-Sn, Ti-Nb or Sn-Sb(Ta) alloy targets, respectively, will be reported in detail. References: Nb:TiO₂: Applied Surface Science, 301(2014) 551., TiO₂: Thin Solid Films 496 (2006) 126., Al:ZnO: Thin Solid Films 518 (2010) 2980., Al:ZnO: J. Vac. Sci. Technol. A 28(4) (2010) 890., Ta:SnO₂: Thin Solid Films 520 (2011) 1178., Thin Solid Films 520 (2012) 3746., ITO: Thin Solid Films 520 (2012) 4101., Al:ZnO: Thin Solid Films 520 (2012)3751., TiO₂: J. Vac. Sci. Technol. A26(4), (2008) 893., Al:ZnO: Thin Solid Films 517 (2009) 3048., WO₃: Thin Solid Films 532 (2013) 1., APL MATERIALS 3, 104407 (2015).

Keywords

reactive sputtering

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