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Preparation of metal nitride and oxide thin films using shielded reactive vacuum arc deposition

R. Miyano, K. Kimura, K. Izumi, H. Takikawa*, T. Sakakibara

Department of Electrical and Electronic Engineering, Toyohashi University of Technology, Tempaku-cho, Toyohashi, Aichi 441-8580, Japan

Abstract

Various metal nitride and oxide thin films were prepared using a shielded reactive vacuum arc deposition. The cathode materials used as metal ion sources were Al, Ti, Cu, Cr, and Zn. These nitride and oxide films were deposited in pure N₂ and O₂ gas flows, respectively. First, the films were deposited for a short period by both non-shielded and shielded methods, and the macrodroplet appearance on the films was compared. Macrodroplets were reduced remarkably, to less than one-hundredth for Al in N₂, Zn in N₂ and Al in O₂. For Ti in N₂, Cr in N₂, Cu in N₂, Ti in O₂, and Zn in O₂, the macrodroplets were reduced by one-third, although they were not reduced for Cr in O₂. X-ray diffraction analysis revealed that crystallized films were AlN, TiN, CrN, Cu₃N with Cu, CuO, and ZnO, and that amorphous films were Al₂O₃, TiO₂ and Cr oxide. Zn₃N₂ were weakly synthesized in Zn metal film. AlN, Al₂O₃ and TiO₂ films were very transparent with refractive indices of 2.1, 1.6 and 2.3 at 500 nm, respectively. ZnO film also exhibited good transparency. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Shielded reactive vacuum arc deposition; Nitride and oxide films; Macrodroplets; Crystalline state; Optical property

1. Introduction

Metal nitride and oxide thin solid films are useful for a variety of high-performance applications in many industrial fields, such as hard coatings, optical coatings, tribological coatings, electrically conductive and non-conductive films, barrier layers in semiconductors, and sensors. Currently, these films are prepared by various methods of liquid-phase coatings, chemical vapor depositions

* Corresponding author. Tel.: + 81-532-44-6727; fax: + 81-532-44-6757.

E-mail address: takikawa@eee.tut.ac.jp (H. Takikawa).