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Sol-gel preparation of self-cleaning SiO_2-TiO_2/SiO_2-TiO_2 double-layer antireflective coating for solar glass

Wensheng Lin[†], Jiaxian Zheng[†], Lianghong Yan[*], Xinxiang Zhang[*]

Abstract: Self-cleaning SiO_2-TiO_2/SiO_2-TiO_2 double-layer antireflective (AR) coating is prepared by sol-gel process. SiO_2 sol is prepared by using tetraethyl orthosilicate (TEOS) as precursor and ammonia as catalyst, while TiO_2 sol was prepared by using tetrabutyl orthotitanate (TBOT) as precursor and hydrochloric acid as catalyst. The effect of TiO_2 content on refractive index, abrasion-resistance and photo-catalytic activity of SiO_2-TiO_2 hybrid thin films or powders is systematically investigated. It is found that the refractive index of SiO_2-TiO_2 hybrid thin films increases gradually from 1.18 to 1.53 as the weight ratio of TiO_2 to SiO_2 increased from 0 to 1.0. The SiO_2-TiO_2 hybrid thin film and powder possesses good abrasion-resistance and photo-catalytic activity, respectively, as the weight ratio of TiO_2 to SiO_2 is 0.4. The degradation degree of Rhodamine B by SiO_2-TiO_2 hybrid powder is 88.3%. Finally, SiO_2-TiO_2/SiO_2-TiO_2 double-layer AR coating with high transmittance, abrasion-resistance and self-cleaning property is realized.

Keywords: Sol-gel process; antireflective coating; silica; titania; self-cleaning

1. Introduction

Photovoltaic (PV) power is one of the renewable energies, which has been developing rapidly in China because of the environmental problem. PV installations were installed outdoors and even in the sun-baked deserts. Therefore, glass covers are essential for preventing PV cells from damage of physical shock and corrosion. The refractive index of glass covers is approximately 1.52. The difference between air and glass cover results in about 8% reflection on the surfaces of cover glass. This reduces the efficiency of the PV cells. Antireflective (AR) coatings have been widely used in optical devices and energy-related applications to reduce transmission losses [1-4]. An ideal homogeneous AR coating can realized 100% transmittance at a specific wavelength when its

[*]W Lin, J Zheng,· X Zhang (✉)
College of Materials Engineering, Fujian Agriculture and Forestry University, 350002, Fuzhou, China
e-mail: xxzhang0106@163.com
L. Yan (✉)
Research Center of Laser Fusion, China Academy of Engineering Physical, Mianyang 621900, China
e-mail: yanlianghong@126.com
[†]These authors contributed equally to this work.