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Photocarrier dynamic measurement of rutile TiO₂ films prepared by RF magnetron reactive sputtering

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Abstract

In this work, rutile titanium dioxide (TiO₂) films were prepared on quartz and SiO₂/Si substrates utilizing RF magnetron reactive sputtering technology. Crystal structure, surface morphology and optical property of these films were characterized to verify the obtainment of well crystalline rutile TiO₂ films. The dynamics of photocarriers were studied by using temporally resolved transient absorption measurements. The differential reflectivity as a function of pump fluence was investigated. We also directly obtained a carrier lifetime of about 286 ps. The absorption cross-section and the absorption coefficient of free carrier at 800 nm were $1.87 \times 10^{-17} \text{ cm}^2$ and 32.9 cm^{-1} , respectively.

Keywords: Rutile titanium dioxide; Sputtering; Thin films; Carrier dynamics; Free carrier absorption

1. Introduction

In recent years, titanium dioxide (TiO₂) has drawn great attention and been widely investigated due to its optical and electronic properties. TiO₂ thin films have various applications, such as photocatalysis [1], dye sensitized solar cells [2], biomaterials [3],

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