# ADVANCES IN MATERIALS ENGINEERING

## Volume 2

Edited By:
Md Abdul Maleque
Iskandar Idris Yaacob
Zahurin Halim

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# Table of Content

Chapter 034

# X-ray Photoelectron Studies on the Surface Chemical States of Yttria-Stabilized Zirconia Thin Film in Aqueous Acid Hydrofluoric

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**Keywords:** Yttria-Stabilized Zirconia (YSZ), Asid hydrofluoric (HF), Surface chemical states, X- ray photoelectron spectroscopy (XPS).

**Abstract.** This chapter discusses on the surface chemical states of yttria-stabilized zirconia (YSZ) thin films that were treated by aqueous asid hydrofluoric (HF). The magnetron-sputtered YSZ thin films on glass substrates were cleaned in ethanol and dipped in 5% HF solution before being rinsed in either in deionized water (DIW) or ethanol. The surface chemical state of the YSZ thin films were characterized by x-ray photoelectron spectroscopy (XPS). XPS spectra showed that after the HF-dipping, the ratio of the yttrium, Y content of the YSZ thin film surface increased, which probably due to selective etching of zirconium and/or re-adsorption of Y atoms after the etching. From XPS results also, we found that by rinsing with DIW, the excess Y content as a result from the HF-dipping will be removed, but will remain if the surface is rinsed by ethanol solution.

## Introduction

Yttria-stabilized zirconia [$(ZrO_2)_{1-x}(Y_2O_3)_x$ : YSZ], is a zirconium-oxide based material, in which the particular structure of zirconium oxide ($ZrO_2$) is made stable at room temperature by addition of yttrium oxide ($Y_2O_3$). YSZ is usually used in solid oxide fuel cell [1, 2], thermal barrier coating[3], as the high-k gate dielectric material[4-6], and also in sensor application[7]. In our work, we have reported the use of YSZ thin film as a seed layer for low-temperature poly-Si growth[8]. We found that the chemical treatment of the YSZ thin films prior to the Si film deposition played an important role in the crystallization of the deposited poly-Si thin film. In this paper, we discuss the chemical states of the YSZ thin film surfaces that undergo the wet chemical processes based on the results of x-ray photoelectron spectroscopy, XPS.