# X-RAY DIFFRACTION STUDIES OF $TiO_2$ POWDERS BY A SOL-GEL METHOD

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## ABSTRACT

## X-RAY DIFFARCTION STUDIES OF $TiO_2$ POWDERS BY SOL GEL METHOD

Titanium dioxide ($TiO_2$) powders were synthesized by the sol-gel method under room temperature using titanium (IV) methoxide as the precursor. The $TiO_2$ powders were set to values of pH 8 and pH 6 respectively in order to observe its effect on the crystalline structure. Beside, the $TiO_2$ powders were calcined at 800 °C for 3, 5, and 10 hours of heat treatment. The synthesized powders were characterized by X-ray diffraction (XRD). XRD patterns revealed that, the samples possessed a mixed crystalline structure where pH 8 $TiO_2$ powder comprising of anatase and rutile, meanwhile, pH 6 $TiO_2$ powder consisting of anatase, rutile and minor amounts of brookite crystalline structure. Upon heating, the anatase was improved to rutile as the time increased. By lowering the pH, the transformation of anatase-rutile was consumed lower time of heat treatment. In TGA results, the stable weight loss of pH 8 and pH 6 $TiO_2$ powders were observed in the temperature range of 700 °C to 900 °C.

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Nanomaterials is a research field on the materials with extremely small feature in size which is so-called nanoscale. It studies about the morphological features and its special properties in this scale. The research field based on nanomaterials would give beneficial potential in the future technologies. Nanomaterials are generally defined as those materials that have a characteristic length scale (that is, particle diameter, grain size, layer thickness, etc) smaller size than 100nm (1nm = $10^{-9}$). Nanomaterials can be in the form of metallic, polymeric, ceramic, electronic, or composite. At nanoscale, the properties of the materials are neither that of the molecular or atomic level nor that of the bulk material. Although a tremendous amount of research and development activities has been devoted to this topic in the past decade, early research on nanomaterials dates back to the 1960s when chemical flame furnace were used to produce particles smaller than one micron (1 micron = $10^{-6}$ = $10^{3}$nm) in size.