

UNIVERSITI TEKNOLOGI MARA

**CHARACTERIZATION OF AL-DOPED
TiO₂ THIN FILM SYNTHESIZED VIA
SOL-GEL METHOD FOR SOLAR
CELL APPLICATION**

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ABSTRACT

The scope of this research is to synthesize and characterize a TiO₂ thin film to be used in solar cell application. The Al-doped TiO₂ thin film was synthesized via the sol-gel method. The sample produced was characterized using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FT-IR). These XRD characterization was conducted to determine the aluminum bond on the surface of the Al-doped TiO₂ while the FT-IR characterization was used to determine the functional group present. FT-IR spectra of Al-doped TiO₂, titania precursor and alumina source is illustrated in Fig. 1. The 3000 cm⁻¹ band was attributed to the hydroxyl group from water and ethanol occluded in the titania pore. The OH bending band of water in gel was observed at 1600 cm⁻¹ while the O-Ti-O band was observed at 1400 cm⁻¹. The presence of additional peaks indicated the dispersion of doping ions was not efficient. By comparison with the alumina dopant, the bands at 1300 cm⁻¹ was attributed to Al-O bonds. The results obtained from the XRD analysis were inconclusive due to the sample exhibiting a wet nature when prepared for the XRD analysis. The XRD analysis should indicate a peak around 25° for the formation of the anatase phase of Al-doped TiO₂ thin film.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

The energy crisis is the concern that the limited natural resources used to power industrial society are diminishing. While they do occur naturally, it takes hundreds of thousands of years to replenish them and as such, governments and concern individuals are working to make use of renewable resources to decrease the irresponsible use of natural supplies (Kukreja, n.d.-c). The energy crisis currently devastating the planet can be the result of a multitude of reasons, these include overconsumption whereby a strain is put on non-renewable resources such as fossil fuel used as oil, gas and coal which also puts a strain on the environment, overpopulation in which the steady increase in the world's population causes an increase in products none of which can be made or transported without a significant drain on current energy resources, poor infrastructure where many energy producing companies keep on using obsolete machinery which restricts the production of energy, delay in commissioning new power plants which causes currently available plants to undergo huge stress to meet the daily demand for power, wastage of energy in most parts of the world, poor distribution systems which causes frequent tripping and breakdowns, major accidents and natural calamities which interrupt the distribution of energy and to the energy supply itself and of course unexplored renewable energy options due to the current population being more comfortable with something that has been used for a long time such as fossil fuels instead of looking at different options of energy resources such as solar power or wind power (Kukreja, n.d.-a).