

**PENGARUH KONSENTRASI Ag PADA SINTESIS  $\text{Ag}_x\text{ZnSnS}_4$  SEBAGAI  
LAPISAN *BUFFER* SEL SURYA BERBASIS CZTS**

**SKRIPSI**

*Diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains Program  
Studi Fisika di Departemen Pendidikan Fisika*



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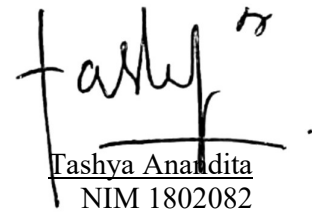
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## PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul “**PENGARUH KONSENTRASI Ag PADA SINTESIS  $Ag_2ZnSnS_4$  SEBAGAI LAPISAN BUFFER SEL SURYA BERBASIS CZTS**” ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung risiko/sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

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Yang membuat pernyataan



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## KATA PENGANTAR

Puji syukur penulis panjatkan kehadirat Allah SWT karena hanya atas rahmat dan hidayah-Nya penulis dapat menyelesaikan proposal skripsi dengan judul “PENGARUH KONSENTRASI Ag PADA SINTESIS  $\text{Ag}_2\text{ZnSnS}_4$  SEBAGAI LAPISAN BUFFER SEL SURYA BERBASIS CZTS”.

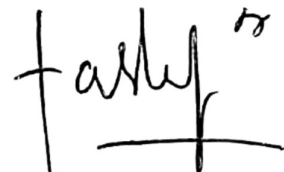
Shalawat beserta salam semoga tetap tercurahlimpahkan kepada Nabi Muhammad SAW, kepada keluarganya, sahabat-sahabatnya, tabi'in tabi'at dan seluruh ummatnya yang selalu taat dan patuh pada ajarannya.

Penulis yakin bahwa dalam penulisan skripsi ini tidak akan terlaksana tanpa adanya bimbingan dan arahan dari berbagai pihak. Begitu pula penulis menyadari sepenuhnya penulisan ini masih jauh dari kesempurnaan dikarenakan keterbatasan ilmu pengetahuan yang penulis miliki. Oleh karena itu saran maupun kritik yang sifatnya membangun sangat penulis harapkan demi perbaikan di masa yang akan datang.

Semoga penelitian ini dapat bermanfaat dan menambah wawasan, serta menjadi sumbangan yang cukup berarti bagi dunia ilmu pengetahuan. Semoga semua pihak yang telah memberikan bantuan apapun kepada penulis mendapatkan yang terbaik dari Allah SWT.

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Bandung, Agustus 2022



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## ABSTRAK

### PENGARUH KONSENTRASI Ag PADA SINTESIS $\text{Ag}_2\text{ZnSnS}_4$ SEBAGAI LAPISAN *BUFFER* SEL SURYA BERBASIS KESTERIT

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Inovasi terus dikembangkan untuk membuat sel surya, termasuk material yang digunakan.  $\text{Ag}_2\text{ZnSnS}_4$  (AZTS) adalah material yang memungkinkan untuk meningkatkan efisiensi sel fotovoltaik. Pada penelitian ini, konsentrasi Ag pada sintesis  $\text{Ag}_2\text{ZnSnS}_4$  pada lapisan tipis dan dijadikan lapisan *buffer* pada sel surya berbasis CZTS dengan menggunakan metode berbasis larutan. Untuk mendapatkan lapisan tipis  $\text{Ag}_2\text{ZnSnS}_4$  yang optimal, konsentrasi Ag divariasikan dengan rasio  $\text{Ag}/(\text{Zn}+\text{Sn})$  0,75;0,80;0,85; dan 0,90. Dari hasil pengukuran diperoleh bahwa struktur mikro menggunakan SEM dan XRD menghasilkan morfologi permukaan berupa pelat berukuran kurang dari  $2\mu\text{m}$  dan memperoleh fasa AZTS dengan struktur kristal pirquitasit. Pengukuran sifat optik dilakukan untuk mengetahui energi *bandgap* terendah 2,45 eV dan LHE tertinggi sebesar 63,10%. Sintesis material AZTS sebagai lapisan *buffer* dimasukkan ke dalam sel surya dengan struktur ITO/CZTS/AZTS/HTM/rGO/ITO menghasilkan efisiensi tertinggi sebesar 4,41%,  $J_{sc}$  3,11  $\text{mA}/\text{cm}^2$ ,  $V_{oc}$  sebesar 3,35 volt dan Fill Factor (FF) sebesar 67,96%.

**Kata Kunci :** AZTS, lapisan buffer, sel surya, CZTS, dan konsentasi Ag

## ABSTRACT

### ***EFFECT OF Ag CONCENTRATION ON THE SYNTHESIS OF $Ag_2ZnSnS_4$ AS BUFFER LAYER IN SOLAR CELL BASED ON KESTERITE***

*by*

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*Innovations continue to be developed to make solar cells, including the materials used.  $Ag_2ZnSnS_4$  (AZTS) is a material that makes it possible to increase the efficiency of photovoltaic cells. In this study, the concentration of Ag in the synthesis of  $Ag_2ZnSnS_4$  was made in a thin layer and used as a buffer layer in CZTS-based solar cells using a solution-based method. To obtain an optimal  $Ag_2ZnSnS_4$  thin film, the Ag concentration was varied with the ratio  $Ag/(Zn+Sn)$  0,75;0,80;0,85; and 0,90. From the measurement results, it was found that the microstructure using SEM and XRD resulted in surface morphology in the form of plates measuring less than  $2\mu m$  and obtained the AZTS phase with a pirquitasite crystal structure. Measurement of optical properties was carried out to determine the lowest bandgap energy of 2,45 eV and the highest LHE of 63,10%. Synthesis of AZTS material as a buffer layer is inserted into a solar cell with the structure ITO/CZTS/AZTS/HTM/rGO/ITO resulting in the highest efficiency of 4,41%,  $J_{sc}$  3,11 mA/cm<sup>2</sup>,  $V_{oc}$  of 3,35 volts and Fill Factor (FF) of 67,96%.*

**Keywords:** *AZTS, buffer layer, solar cells, CZTS, and Ag concentration*

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