PENGARUH TEMPERATUR SUBSTRAT TERHADAP KUALITAS KRISTAL LAPISAN TIPIS $Sn(S_{0,2}Te_{0,8})$ HASIL PREPARASI DENGAN TEKNIK EVAPORASI VAKUM

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui struktur kristal dan parameter kisi lapisan tipis $Sn(S_{0,2}Te_{0,8})$, mengetahui pengaruh temperatur substrat terhadap kualitas struktur kristal lapisan tipis $Sn(S_{0,2}Te_{0,8})$, dan mengetahui morfologi permukaan serta komposisi kimia lapisan tipis $Sn(S_{0,2}Te_{0,8})$ yang dipreparasi dengan metode evaporasi vakum.

Proses preparasi lapisan tipis $Sn(S_{0,2}Te_{0,8})$ dilakukan dengan menggunakan teknik evaporasi vakum yang bekerja pada tekanan (5×10^{-5}) mbar dengan melakukan variasi temperatur substrat. Temperatur substrat divariasi sebanyak 4 kali, yaitu 250°C, 300°C, 350°C, dan 400°C. Setelah sampel lapisan tipis dihasilkan, sampel kemudian dikarakterisasi menggunakan XRD (*X-Ray Diffraction*) untuk mengetahui struktur kristal, SEM (*Scanning Electron Microscopy*) untuk mengetahui morfologi permukaan, dan EDS (*Energy Dispersive Spectroscopy*) untuk mengetahui komposisi kimia.

Hasil karakterisasi XRD dianalisis menggunakan metode analitik dan penghalusan (*refinement*) dengan metode *Le Bail* pada *software* komputer LPHM-*Rietica*. Analisis metode analitik dan *Le Bail* menunjukkan bahwa keempat sampel memiliki struktur kristal kubik dengan parameter kisi sampel 1 (temperatur substrat 250°C): $a = b = c = 6{,}049$ Å, sampel 2 (temperatur substrat 300°C): $a = b = c = 6{,}109$ Å, sampel 3 (temperatur substrat 350°C): $a = b = c = 6{,}259$ Å, sampel 4 (temperatur substrat 400°C): $a = b = c = 6{,}442$ Å, sedangkan parameter kisi dengan metode *Le Bail*, sampel 1 (temperatur substrat 250°C): $a = b = c = 6{,}281$ Å, sampel 2 (temperatur substrat 300°C): $a = b = c = 6{,}317$ Å, sampel 3 (temperatur substrat 350°C): $a = b = c = 6{,}327$ Å, sampel 4 (temperatur substrat 400°C): $a = b = c = 6{,}327$ Å. Variasi temperatur substrat menyebabkan adanya perbedaan kualitas lapisan tipis tiap sampel yang ditandai dengan adanya perbedaan intensitas spektrum. Hasil karakterisasi SEM menunjukkan ketebalan lapisan tipis (~0,6) μm dan morfologi permukaan sampel terdiri atas butiran (*grain*) berukuran (~0,2) μm yang menandakan adanya keseragaman bentuk, struktur, dan warna butir, sehingga morfologi permukaan cukup merata dan terdistribusi secara homogen. Berdasarkan hasil EDS, lapisan tipis $Sn(S_{0,2}Te_{0,8})$ mengandung unsur Sn, S, dan Te dengan persentase komposisi kimia Sn = 52,31%, S = 0,88%, dan Te = 46,81%. Perbandingan molaritas Sn : S : Te adalah 1,04 : 0,02 : 0,94.

Kata kunci: semikonduktor, lapisan tipis $Sn(S_{0,2}Te_{0,8})$, teknik evaporasi

THE EFFECT OF SUBSTRATE TEMPERATURE VARIATIONS ON THE CRYSTAL QUALITY OF THE $Sn(S_{0,2}Te_{0,8})$ THIN FILMS PREPARATION BY VACUUM EVAPORATION METHOD

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ABSTRACT

This research aims to know the crystal structure and lattice parameter of $Sn(S_{0,2}Te_{0,8})$ thin films, to know the effect of substrate temperature on the crystal quality of $Sn(S_{0,2}Te_{0,8})$ thin films, to know the surface morphology and chemical composition of $Sn(S_{0,2}Te_{0,8})$ thin films which prepared by vacuum evaporation technique.

The preparation prosess of $Sn(S_{0,2}Te_{0,8})$ thin films were performed using vacuum evaporation technique that worked on (5×10^{-5}) mbar pressure with substrate temperature variations. The substrate temperatures were varied for four times, namely 250°C, 300°C, 350°C and 400°C. After thin films preparation had finished, samples were characterized by XRD (X-Ray Diffraction) to determine the crystal structure, SEM (Scanning Electron Microscopy) to determine the surface morphology, and EDS (Energy Dispersive Spectroscopy) to determine the chemical composition.

The XRD characterization results were analyzed using the analytical method and smoothing (refinement) by Le Bail method in LPHM-Rietica computer program. Analysis of the analytical method and Le Bail showed that the four samples had cubic crystal structure with the lattice parameters of analitical method were sample 1 (the substrate temperature was 250°C): $a = b = c = 6.049$ Å, sample 2 (the substrate temperature was 300°C): $a = b = c = 6.109$ Å, sample 3 (the substrate temperature was 350°C): $a = b = c = 6.259$ Å, and sample 4 (the substrate temperature was 400°C): $a = b = c = 6.442$ Å, while the lattice parameters of Le Bail method were sample 1: $a = b = c = 6.281$ Å, sample 2: $a = b = c = 6.317$ Å, sample 3: $a = b = c = 6.327$ Å, sample 4: $a = b = c = 6.327$ Å. The substrate temperature variations caused the difference in thin films quality, marked by the difference of spectrum intensity. SEM characterization showed that surface morphology of samples consisted of grains which indicated the uniformity of the shape, structure, and color of the grains with (~0,2) µm size, so that the surface morphology was distributed homogeneously with (~0,6) µm thickness. Based on the results of EDS, $Sn(S_{0,2}Te_{0,8})$ thin films contained elements of Sn, S, and Te with the chemical composition percentages were Sn = 52.31%, S = 0.88%, and Te = 46.81%. So, the molarity comparisons of Sn : S : Te was 1 : 0.02 : 0.94.

Keywords: semiconductor, $Sn(S_{0,2}Te_{0,8})$ thin films, cavuum evaporation method