

## Abstract

Thin films of CdTe have been deposited by electron beam sputtering of 99.99% purity CdTe granules (0.7-3.5mm diameter) on glass substrates at temperature of approximately 60°C. The structural, optical and electro-optical properties of these films were then characterized.

Structural studies revealed either a polycrystalline or amorphous structure while compositional studies by electron microprobe analysis showed excess Te in the films. Measurements of the lattice constant established a stress related dilation in this parameter. The magnitude of this stress seem to increase with the density of excess Te. In addition the concentration of the excess Te were found to vary linearly with the inverse of the film thickness.

Optical transmittance measured in the range of 300-3200 nm showed some interesting features in the films. In particular a blue shift in the optical band gap was observed. This was analyzed according to Brus's model of quantum confinement. An iterative method was also developed to fit a theoretical expression to measured transmittance, enabling the determination of the thickness and dispersion of refractive index of the films. The dispersion of the refractive index were then interpreted according to Wemple and Di Domenico's single oscillator model.

The electro-optical properties of the films were studied within the boundaries of photoconductivity and dark conductivity. In the case of dark conductivity two distinct conduction mechanisms could be observed in the temperature range of 100-300K.

Analysis of photoconductivity data following Shockley and Read's model of recombination showed gap states which increases exponentially towards the valence band in polycrystalline films. In contrast an initial decrease followed by an exponentially increasing gap states was found in amorphous films.

## Abstrak

Filem nipis CdTe telah dimendapkan ke atas substrat kaca pada suhu dalam lingkungan  $60^{\circ}\text{C}$  secara percikan alur elektron ke atas granul (diameter 0.7-3.5mm) CdTe berketulenan 99.99%. Struktur, sifat-sifat optik dan elektro-optik filem-filem ini kemudiannya telah dicirikan.

Kajian struktur menunjukkan samada struktur polihablur atau amorfus, sementara kajian komposisi dengan mikroduga elektron mendapati Te yang berlebihan di dalam filem-filem tersebut. Ukuran pemalar kekisi mendapati dilasi pemalar kekisi berkaitan dengan tekanan. Magnitud tekanan ini didapati bertambah dengan ketumpatan Te yang berlebihan. Selain itu ketumpatan Te yang berlebihan berubah secara berkadar terus dengan songsangan ketebalan filem.

Kehantaran optik yang diukur dalam julat 300-3200nm mempamerkan berbagai ciri-ciri yang menarik di dalam filem-filem ini. Khususnya suatu penganjakan biru dari jurang tenaga dicerap. Ini telah dikaji dengan model pengurangan kuantum Brus. Kaedah iterasi telah diperkenalkan dan digunakan untuk membandingkan persamaan teoritikal dengan kehantaran yang diukur membolehkan penentuan ketebalan dan penyebaran indeks biasan filem-filem tersebut. Penyebaran indeks biasan ini kemudiannya telah diterangkan mengikut model pengayun tunggal Wemple dan Di Domenico.

Kajian elektro-optik filem-filem ini dihadkan kepada fotokekonduksian dan kekonduksian gelap. Untuk kes kekonduksian gelap dua mekanisme kekonduksian jelas kelihatan antara suhu 100-300 K.

Analisa data fotokekonduksian mengikut model penggabungan Shockley dan Read menunjukkan keadaan tenaga antara jurang yang bertambah secara eksponen ke arah jalur valens di dalam filem polihablur. Sebaliknya suatu pengurangan diikuti dengan pertambahan secara eksponen di dalam keadaan tenaga antara jurang didapati dalam filem amorfus.