# ABSTRACT

Hydrogenated amorphous silicon (a-Si:H) films were prepared from the discharge of pure silane and silane diluted in argon using a home-built horizontal direct current(d.c.) plasma glow discharge system. The effects of argon dilution of silane on the optical properties, chemical bonding properties, hydrogen content and microstructure parameter of the films produced were studied and analyzed. Film thickness, refractive index, optical energy gap and the Urbach tail bandwidth were obtained from the optical transmission spectra of the films while the H content and the microstructure parameter were derived from the Fourier Transform infra-red(FTIR) spectra of the films. The FTIR spectra also provided information on the chemical-bonding properties, purity and homogeneity of the film structure. Results showed that these properties were dependent on the argon to silane flow-rate ratio in most cases. High argon dilution had the effects of decreasing the refractive index of the film and indirectly the bulk density of the film, the microstructure content as well as the total hydrogen content of the a-Si:H film. Film homogeneity also increased in the higher argon diluted film. Low argon dilution resulted in increase in the deposition rate but high argon dilution (argon to silane flow-rate ratio larger or equal to one), resulted in retardation in the growth rate. High deposition rate films had low refractive index, low hydrogen content, less disordered structure and high amount of microstructure. The deposition rate, however showed no significant influence on the optical energy gap of the films.

# ABSTRAK

Filem silikon amorfus berhidrogen (a-Si:H) telah disediakan dengan penguraian silane tulen dan silane bercampur argon menggunakan sistem nyahcas plasma arus terus mendatar yang direka di makmal. Kesan campuran argon terhadap sifat-sifat optik, ikatan kimia, kandungan hidrogen dan parameter struktur mikro filem-filem yang terhasil dikaji dan dianalisis. Ketebalan filem, index biasan, jurang tenaga optik dan lebar tenaga Urbach diperolehi daripada spektra transmisi optik manakala kandungan hidrogen dan parameter struktur mikro diterbitkan daripada spektra transformasi infra-merah Fourier (FTIR). Spektra transformasi infra-merah juga memberikan maklumat tentang ciri-ciri ikatan kimia, ketulenan serta kehomogenan struktur filem. Hasil kerja menunjukkan bahawa kebanyakan ciri-ciri ini bergantung kepada nisbah kadar aliran argon terhadap kadar aliran silane. Kadar aliran argon yang tinggi didapati telah mengurangkan nilai index biasan filem dan secara tidak langsung mengurangkan ketumpatan pukalnya, mengurangkan kandungan struktur mikro dan kandungan hidrogen di dalam filem. Kehomogenan filem juga bertambah dengan kadar aliran argon yang tinggi. Kadar aliran argon yang rendah pula meningkatkan kadar pemendapan filem manakala kadar aliran argon yang tinggi membantutkan proses pemendapan filem. Filem yang terbentuk pada kadar pemendapan yang tinggi mempunyai index biasan yang rendah, kandungan hidrogen yang rendah dan kandungan struktur mikro yang tinggi. Namun, kadar pemendapan filem tidak mempengaruhi jurang tenaga optik.