New Method to Fabricate ZnS Optical Waveguides Using Thermoelectric Devices.

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Abstract

This work describes a new method to fabricate ZnS thin films using the thermal evaporation technique with a low substrate temperature. This work also was undertaken to establish that cold substrate evaporation using thermo electric coolers could be utilised to produce ZnS waveguides. A thermoelectric device which could be used to both heat and cool the substrates was designed and employed to deposit ZnS thin films on polished glass and silicon wafers. The *in-situ* heating and cooling were important factors to ensure that the ZnS films deposited on cold substrates show low loss waveguide characteristics. Optimizing this polycrystalline waveguide fabrication was a considerable challenge compared to the established, conventional waveguide fabrication. Propagation mode and power loss measurement were done by a commercial prism coupling method which is fitted with He-Ne laser and diode lasers. The transverse electric mode (TE) and loss decrease when the wavelength is increased. These observations agree well with a Rayleigh scattering model of the loss mechanism. The lowest loss of polycrystalline ZnS waveguide is 2.23 dB/cm measured a wavelength of 1540 nm.