Incorporation of oxygen into thermally evaporated germanium and optical characterization of the resulting films

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(Received 8 June 2007; accepted 12 July 2007; published online 11 September 2007)

Germanium powder was thermally evaporated under a vacuum onto unheated substrates as well as substrates heated to 200 °C. The striking feature was that the resulting films were transparent. Chemical analysis using x-ray photoelectron spectroscopy depth profiling indicated that oxygen was present throughout the thickness of the films, and therefore the films were composed of substoichiometric germanium oxide. The source of oxygen was investigated, and traced to the source material. Subsequently, the optical constants and the band gaps of the films were determined from spectrophotometric measurements. These properties were found to be intermediate between those of pure germanium and germanium dioxide, with values appropriate for optical applications in the visible range. [DOI: 10.1063/1.2776007]