A parametric model for temperature dependence of dielectric function of AlSb film

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AlSb is a remarkable material for wide applications such as high electron mobility transistors, solar cells, and type-II superlattice infrared photodiodes. Ellipsometry is an eminent technique as a non-destructive method to investigate the dielectric function of materials without need of the Kramer-Kronig relation. Several studies presented the ellipsometric study of AlSb at room and high temperature. However, to apply properly for device applications, the dielectric function of AlSb film had better be well known at arbitrary temperature.

In this work, AlSb film is grown on a (001) GaAs substrate in a Riber compact 21E solid-source molecular beam epitaxy system with a rotating sample stage. Oxide layer on substrate is removed under As_2 flow at 893 K. In order to reduce the existence of surface roughness on GaAs substrate as much as possible, approximately 200 nm thickness of GaAs buffer layer was grown at the same temperature. The film thickness is 1.5 ?m that is significantly larger than the critical thickness of AlSb. Therefore, its dielectric function then is closely approximate those of bulk material. An accurate analytic expression of dielectric function of AlSb film is reported by using parametric model for energies from 0.7 to 5.0 eV and temperatures from 300 to 803 K. The parameters were extracted by fitting the spectra with the reconstructed model made by seven dispersive oscillators at each measured data. The dependence of temperature is achieved from the model parameters that are fitted by polynomial and then the dielectric functions of AlSb for arbitrary temperature is determined. These results are expected to be useful in design and understanding in applied device technologies based on AlSb film.