OPTICAL CHARACTERIZATION OF HYDROGENATED AMORPHOUS SILICON-CARBON FILMS IN A WIDE SPECTRAL RANGE

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The optical characterization of hydrogenated amorphous silicon-carbon (a-SiC:H) films has been performed in the wide spectral range from far IR to vacuum UV.

The films were prepared from tetravinylsilane on double-sided polished float-zone silicon wafers (100) by plasma-enhanced chemical vapor deposition process operated in a pulsed mode. Dielectric response of the a-SiC:H films were described by Universal dispersion model containing several contributions: excitations of valence electrons, Urbach tail, absorption on localized states and phonons.

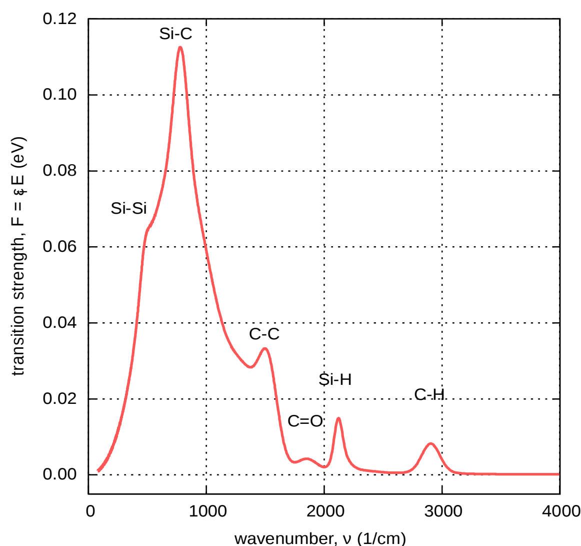

Fig.1: Transition strength function of a-SiC:H in IR region modeled using Voigt peaks.

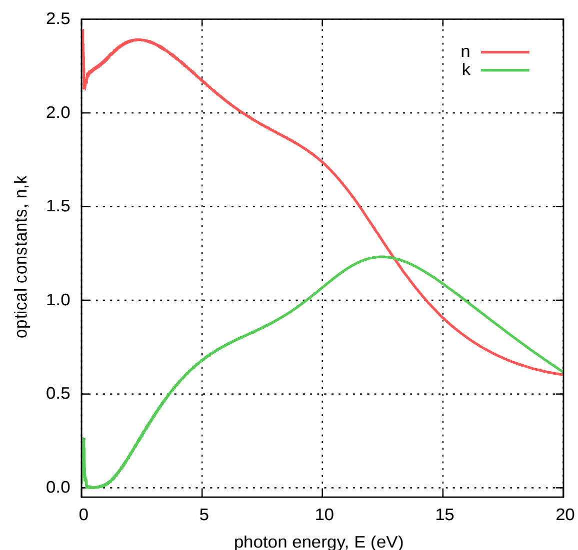

Fig.2: Optical constants of a-SiC:H in UV region described by Campi-Coriasso dispersion model.

Five models combining the Tauc law with Lorentz functions were tested for valence electron excitations. The Urbach tail was described by recently developed model. Phonon excitations were described using broadened discrete spectrum. The Voigt distribution function for broadening was compared with the linear combination of Gaussian and Lorentzian distribution functions. Films have exhibited a refractive index profile, roughness, and oxide transition or overlayers. All these effects were taken into account in the interpretation of experimental spectrophotometric and ellipsometric data.

Keywords: Silicon-carbon films; Universal dispersion model; Dielectric response