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FANO RESONANCE IN AMORPHOUS SILICON NITRIDE

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Resonant photoemission is becoming a very important experimental method in the study of localized states present in the band structure of metals and semiconductors[1]. A resonant process is the enhancement of the primary photoelectron yield when the photon energy coincides with the transition energy from a core level to empty localized states. At these photon energies there could be more than one final state configuration to which the system can be excited upon absorption of a photon. It is essentially the interaction among these different final state configurations that causes the resonant enhancement[1].

The enhanced photoemission intensity vs the photon energy exhibits the characteristic line profile predicted by Fano[2]. Photoemission spectra were taken in Constant Initial State (CIS) mode. The chosen initial state was near 2 eV binding energy and a resonant feature with a maximum near $h\nu$=21 eV is shown in Fig. 1.

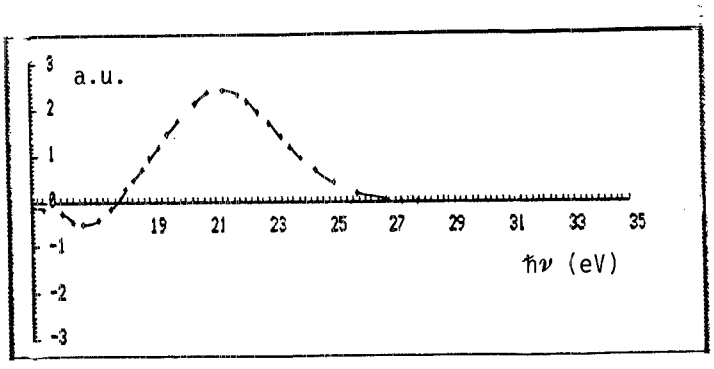

Fig. 1 - Fano-line-shape of the CIS spectrum.

The curve is the amplified difference of the CIS spectrum and a quadratic non resonant background to better evidence the resonant behavior. Since the N2s core level is 18.2 eV below the top of the valence band[3] and the energy gap of silicon nitride is 5.4 eV[4], the resonant feature of Fig. 1 near 21 eV places the final LS state of the discrete transition well into the energy gap. The resonant peak of Fig. 1 is more likely due to transitions from N2s core levels to the above p-like conduction band states and the excitonic coupling is responsible for the localization and for the energy shift of the optical transition (2.6 eV).

References:

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