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Autor(en): **Valeri, S. / Tonini, R.**

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ION-EXCITED AUGER ELECTRON EMISSION FROM SOLID SURFACES

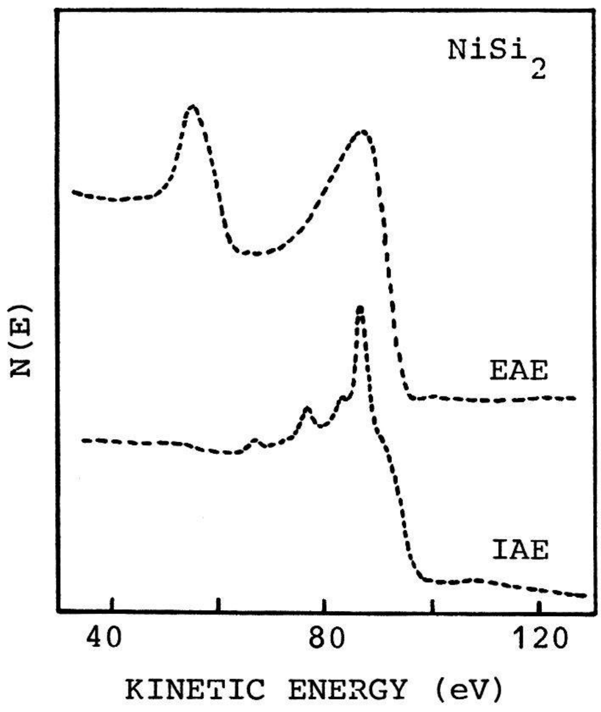
S.Valeri and R.Tonini, Dipartimento di Fisica,Università di Modena,via Campi 213/A, 41100 Modena, Italia.

The ion-excited Auger-electron emission (IAE) from Si and Si compounds has been studied. Inner shell excitation occurs throug crossing of molecular orbitals,as consequence of the ion impact (1). The spectra are markedly different from those related to the electron-excited Auger emission (EAE)(Fig.1).Due to the momentum transfer from the projectile,the target atoms are displaced from their lattice sites and a number of them are sputter-ejected in the free space, thus leading to atomic-like features in the Auger spectra.The investigation has been focused on the Si(L23-derived) spectrum.In the assumption that the bulk contribution to the IAE is roughly represented by the EAE (2,3),the atomic-like features have been obtained by the procedure illustrated in the inset of Fig.2.In figure, we report the results of such a procedure for $NiSi_2$,Ni_3Si and Pt_3Si. Structures related to decay of ions (Si+, Si++) or neutral-excited atoms (Si°) have been identified (4). Our results suggest that neutral-excited atoms are mainly created in autoionization processes during the collision events.

We studied the lineshape and yield dependence on the ion energy,target stoichiometry and collision geometry,to have insight in the inner shell excitation process,electronic states of the target and sputtering mechanisms.

A threshold energy of nearly 1 keV has been observed for the IAE emission.Si atoms with a hole in the L shell originate in PT asymmetric collisions between projectile and target atoms, and in TT symmetric collisions between target atoms in the cascade.Two 2p holes however can only be produced in asymmetric collisions (5).By a detailed investigation of the Si++ feature in the IAE spectra, we determined the threshold energy of the PT events to be 2.9 keV in the Si-metal compounds.

Finally,the dependence of the Si IAE lineshape on the take-off geometry has been interpreted in terms of a Doppler shift of the Auger electron energy.This is attributable to the velocity components of the decaying atoms in the direction of the analyser (3).We conclude that a flux of high energy excited atoms, mainly originate in PT collisions, is anisotropically ejected from the surface,superimposed to the isotropic emission of slow particles.



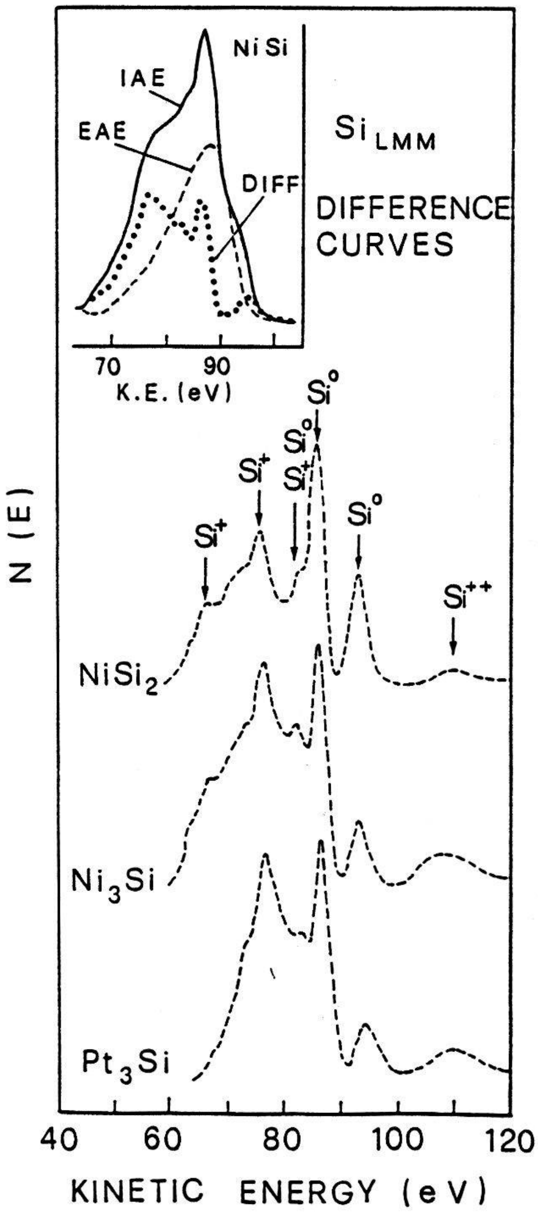


Fig.1- Electron-induced (EAE) and ion-induced (IAE) Auger spectra in $NiSi_2$ at normal take-off angle.

Fig.2- Atomic-like contributions to the Si IAE spectra in Si-rich and metal-rich silicides.

The reduced Si++ yield with respect to the total yield as the incident beam approaches the surface normal, is a clear evidence of the localization of PT collision at the surface.

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