

Fundamental concepts in searching for a better protective layer in PDP

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Abstract

To improve the luminous efficiency and power consumption of plasma display panel(PDP), a protective layer better than currently-used MgO is highly desirable. However, not much is known about the ion impact-induced secondary electron emission from insulator surfaces because of a limited amount of reliable reference data available so far. In this paper, we will present the secondary electron emission coefficients γ of MgO and SiO₂ for low energy (20-250 eV) noble gas ions measured under negligible surface-charging conditions. From the data the condition for the potential emission(PE) is established, and the dependence of γ_0 at zero kinetic energy on the type of material as well as the type of ion is quantitatively explained. In addition to PE, insulators show efficient kinetic emission(KE) at ion energies relevant to PDP environment. We have found that the threshold energies in KE in the center-of-mass frame exactly coincide with the surface ionization energy of a given insulator. This observation enables us to infer the mechanism of KE in insulator; which occurs by a kinetic energy coupling in a binary collision to the electronic degree of freedom via a Pauli exclusion type of repulsive interactions. Thus, the threshold energy measurement can provide the surface ionization energy of insulators, a parameter difficult to get by other means. We will also show the dependence of γ on impurity doping, defects, method of film preparation. Finally, we will draw conceptual guidelines useful in searching for a better protective layer in PDP.