

## The effect of NiO doping on the electrical properties of MgO protective layer

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A MgO protective layer reduces the discharge voltage of AC-PDP (Alternating current – Plasma Display Panel) due to its high secondary electron emission coefficient and protects the dielectric layer from the ion bombardments during the discharge. This report focused on the effect of doping of NiO to the MgO protective layer on the XPS spectra and the electrical properties. The pellets for the source of e-beam evaporation were fabricated by mixing the NiO powder with the MgO powder. Then, the mixed powders were pressed and sintered. To evaluate the discharge property, 2-inch test panels were fabricated. The characteristics of the films were evaluated by XRD, XPS and discharging measurement system. A pure MgO film was evaluated at the same time as a reference.

In case of MgO-1at% NiO film, as shown in SEM image, irregular shape of grains was observed. In case of MgO-5at% NiO film, irregular shape with small size of grains was observed. At the same time, rectangular and triangular shape with large size of grains also observed. In case of MgO-10at% NiO film, the shape of grains was similar to that of the MgO-5at% NiO film, and the grain size of MgO-10at% NiO film was larger than that of the MgO-5at% NiO film. XRD results show that the (111) peak was decreased and (220) peak was increased as the amount of NiO increased. Referring to the JCPDS data of NiO,

the peak of NiO is similar to that of MgO. Therefore, it is not easy to distinguish NiO peak from MgO peak. As known well, NiO also have rock salt structure. Because crystal structure of MgO and NiO are the same, and difference of lattice parameter is very small, these two oxide form completely solid-solution. XPS results show that the valence band spectra of NiO added films were significantly changed with the amount of NiO. Valence band edge of MgO-1at% NiO film is similar to that of the pure MgO. In case of MgO-5at% NiO film and MgO-10at% NiO film, valence band edge was shifted to lower binding states. Therefore, it is considered that the electrical properties of NiO added films were improved by the change of electronic band structure. To figure out the change of density of the NiO added films, quantitative analysis was conducted by electron probe X-ray micro analyzer (EPMA). It is because that the density of NiO added film may be changed the amount of NiO. The density of pure MgO is  $3.6 \text{ g/cm}^3$ , and the density of pure NiO is  $6.7 \text{ g/cm}^3$ . The composition of NiO added film is similar to NiO added pellets. The density of NiO added films was increased. Consequently, the firing voltage and luminance and luminous efficiency of NiO added films were increased by the change of electronic band structure and density.