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Electronic Structure of Al/Metal Fluorides/Alq_3 Interfaces Studied by XPS and UPS

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We have studied the electronic structure of interfaces between Al and tris-(8-hydroxy-quinoline)aluminum (Alq_3) modified by the insertion of fluorides, LiF, CsF, MgF_2, and AlF_3, where enhancements of electroluminescence are expected. We used X-ray photoelectron spectroscopy (XPS) and ultraviolet photoelectron spectroscopy (UPS) to probe the electronic structure changes of core levels and valence bands caused by the insertion of the thin layer of LiF, CsF, MgF_2. and AlF_3 between Al and Alq_3 film. The valence bands of Alq_3 showed significant shifts to higher binding energies with deposition of LiF or MgF_2. Insertion of LiF between Al and Alq_3 film enhanced the formation of the gap state as shown in the Figure 1, however, insertion of MgF_2 did not. The core levels shifted to higher binding energies with the deposition of aluminum in different extents depending upon atomic sites as shown in Figure 2. Reduction of N atomic site of Alq_3 occurred with deposition of Al on LiF/Alq_3, but N atomic sites were not affected for the case of Al/MgF_2/Alq_3.

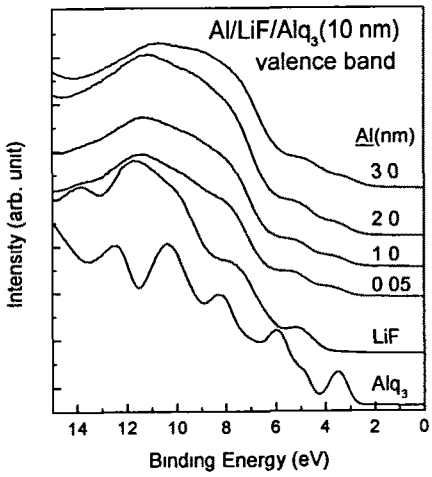

Fig. 1 UPS of Al/LiF/Alq3/ITO

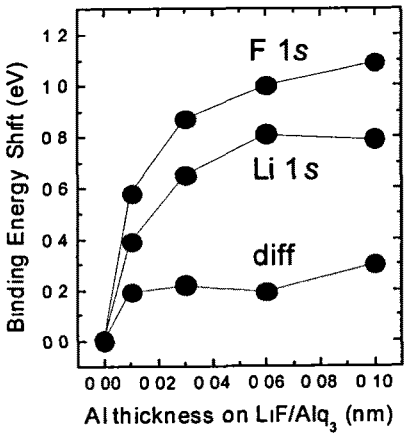

Fig. 2 F 1s and Li 1s core level shifts of Al/LiF/Alq3/ITO