

Phosphor Surface Modification and High vacuum Heat Treatment for Enhancement of LED Device Reliability

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In this study, the reliability of halide red phosphor was enhanced by using high vacuum heat treatment. $K_2SiF_6:Mn^{4+}$ (KSF) as a red-emitting phosphor is proposed to produce the broad gamut in display field and maximize the luminous efficacy in LEDs application since its high efficiency at room temperature and low thermal quenching at high temperature. Despite the excellent properties of KSF phosphor, there are limitation on industrial application because the phosphor including halides and alkali earth elements is considerably vulnerable to moisture. To overcome this problem, the surface modification with In_2O_3 on KSF performed by using sol-gel reaction and the heat treatment was carried under high vacuum condition. After the treatment, the reliability of KSF loaded LED package could be improved. It is because that the waterproof property of KSF was reinforced and the shell density of In_2O_3 was denser by high vacuum heat treatment process without decrease of KSF optical property.