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Bulk and Surface Excitations in Gd_2O_3: Electron Energy Loss Spectroscopy Study S.C. LIOU, M.-W. CHU, C.H. CHEN, CCMS, NTU, Taiwan, Y.J. LEE, M. HONG, Dep. MSE, Hsinchu, Taiwan, J. KWO, Dep. Physcs, Hsinchu, Taiwan — Gd_2O_3 with its high dielectric constant ($\kappa \sim 14$), large band gap (5.4 eV)and thermodynamic stability has featured prominently in the literature as an effective passivation in GaAs substrate to fabricate the metal-oxide-semiconductor field-effect transistors (MOSFETs) and promising candidates for future scaling of CMOS technology. Here, we report studies of electronic excitations of Gd_2O_3 in cubic phase by electron energy-loss spectroscopy (EELS). EELS spectra in bulk Gd_2O_3 reveal several broad spectral features above the optical band gap at ∼7.5, ∼15, ∼17.5, ∼27.5, ∼31.5 and ∼36 eV. We have obtained the dielectric function by performing Kramers-Krönig analysis. The 15 eV peak is identified as bulk-plasmon excitation. The 13.6 eV peak, which is visibly enhanced at thinner areas, arises from excitation of surface-plasmon. The other features at ∼7.5, ∼17.5, ∼27.5, ∼31.5 and ∼36 eV result from bulk interband transitions. Moreover, we note that the 7.5-eV peak associated with interband transition also bears a strong character of surface excitations, as evidenced by measurements carried out in aloof geometry. Detailed characteristics of this unconventional surface excitation will also be discussed.

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