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Synthesis and Characterization of Novel Rare-earth Oxides Precursors

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The rare-earth oxides M2O3 (M=La, Pr, Gd) are good insulators due to their large band gap (3.9eV for Pr2O3, 5.6eV for Gd2O3), they have high dielectric constants (Gd2O3 K=16, La2O3 K=27, Pr2O3 K=26-30) and, compared to ZrO2 and HfO2, they have higher thermodynamic stability on silicon making them very attractive materials for high-K dielectric applications. Another attractive feature of some rare-earth oxides is their relatively close lattice match to that of silicon, offering the possibility of epitaxial growth and eliminating problems related to grain boundaries in polycrystalline films. Metal-organic chemical vapor deposition (MOCVD) has been preferred to PVD methods because of the possibility of large area deposition, good composition control and excellent conformal step coverage. Herein we report on the synthesis of rare-earth oxide complexes with designed alkoxide and aminoalkoxide ligand. These novel complexes have been characterized by means of FT-IR, elemental analysis, and thermogravimetric analysis (TGA).

Keyword: The rare-earth oxides

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Electrical/Dielectric Characterization of 2-Dimenisonal Electron Gas Layers Formed between $LaAlO_3$ and $SrTiO_3$

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Impedance spectroscopy allows for simultaneous characterization of interface-controlled materials and/or devices in terms of electrical and dielectric aspects. Recently, there have tremendous interests in 2-dimensional electron gas layers (2DEGs) involving $LaAlO_3$ and $SrTiO_3$ whose features incorporates extremely high mobility and carrier concentrations along with metallic responses unlike the constituents, $LaAlO_3$ and $SrTiO_3$. Impedance spectroscopy offers the following unique features, such as simultaneous determination of conductivity and dielectric constants, identification of electrical origins among bulk-, grain boundary-, and electrode-based responses. Impedance spectroscopy was applied to the 2DEG $LaAlO_3/SrTiO_3$ system, in order to extract the electrical and dielectric information operating in the 2DEG system. The unique responses of the 2DEG system are investigated in terms of temperature and device structures. The underlying mechanism of the 2DEG system is proposed with the aim to optimizing the high-mobility 2DEG responses and to expedite the associated devices towards the high-density integrated chips.

Keywords: Impedance spectroscopy, $LaAlO_3$ and $SrTiO_3$, 2DEG