**Physico-chemical nanomaterials science**

**Impact of annealing treatment on optical and structural properties of Er2O3 films grown by atomic layer deposition**

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Erbium oxide thin films are mostly considered for microelectronic applications as high-k materials. However, Er2O3 has high refractive index, high optical transparency in the ultraviolet-infrared spectral range and low probability of non-radiative phonon assisted relaxation. This makes such materials very attractive for optical applications.

In this work, the films were grown on Si substrates kept at 300°C by thermal atomic layer deposition using Er(CpMe)3 as a precursor. The films were annealed at 500-1100°C in nitrogen flow for 30 min and studied by means of FTIR, XRD, TEM, ellipsometry and photoluminescence (PL) methods. The effect of annealing treatment on the structural and optical properties of Er2O3 films was investigated.

As-deposited and annealed at TA=500°C films were found to be amorphous. This result is supported by the observation of broad PL band in visible range originated from oxygen vacancies and no PL emission from Er3+ ions. Annealing at TA=600-900°C, stimulated film densification and crystallization. This is evidenced by the increasing of refractive index and decreasing of film thickness as well as appearance of sharp Er3+ PL bands under resonant excitation in the films annealed at TA=900°C. The TA rising up to 1100°C resulted in further increasing of Er3+ PL emission and quenching of PL band from oxygen vacancies. The evolution of FTIR spectra with TA showed that besides Er-O related vibration bands, additional bands related to Si-O-Er vibrations appeared for the films annealed at TA>900°C. This phase can be formed due to a diffusion of silicon atoms from substrate and can be responsible for the lowering of the refractive index. The structural study of the films supported this conclusion. Obtained results offer multifunctional applications of elaborated films as luminescent materials for traditional phosphors applications.

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