Contribution ID: **41** Type: **not specified**

# Influence of solution parameters on the XRD studies and optical constant of CeO2 films

*Wednesday, 21 June 2023 15:30 (20 minutes)*

Cerium Oxide (CeO2) is an n type semiconductor with a high bandgap (3.2eV) , the material is highly transparent in visible region (400-700nm). Although CeO2 is diamagnetic, it shows ferromagnetic properties when it is reduced to a nano level. CeO2 has used widely applications such as gas sensors, energy storage devices, fuell cells, solar cells and optoelectronic devices. CeO2 can be fabricated by various production methods such as spray pyrolysis, pulsed laser deposition, sputtering and sol-gel spin coating. The sol–gel spin coating method has distinct advantages such as cost effectiveness, transparent, multicomponent oxide layers of many compositions on various substrates, simplicity, excellent compositional control and lower crystallization temperature.

In this study, CeO2 films using solutions prepared in different solution parameters [(citric acid molarity and Ce concentration (0,05; 0,1; 0,15; 0,2)], were prepared by sol–gel process using a spin coating technique onto glass substrates. The precursor solution was prepared by dissolving cerium chloride and citric acid in methanol. The coating solution was dropped into glass substrate, which was rotated at 2000 rpm for 30 s using a LAURELL WS-400B-6NPP/ LITE spin coater. After the deposition, the film was dried at 90 oC for 10 min into a furnace to evaporate the solvent and remove organic residuals. The procedures from coating to drying were repeated nine times. The film was then inserted into a tube furnace and annealed in air at 500oC for 1 h.

X-ray diffraction pattern was obtained with a RIGAKU RINT 2200 Series X-Ray Automat-ic Diffractometer using the CuKa radiations (□□= 1.54059 A˚ ) in the range of 2□ between 20 and 80. The diffractometer reflection was taken at room temperature. The crystal structure and orientation of CeO2 nanostructured thin films have been investigated by X-ray diffraction (XRD) method. The XRD result suggests that the film has the cubic CeO2 crystal structure having polycrystalline structure. The films was crystallized with the hexagonal wurtzite structure. The lattice constants, crystalline size and preferred orientation of the films were calculated from X-ray data.

The optical measurement of the film was carried out at room temperature using a SHIMADZU 2450 spectrophotometer in the wavelength range from 200 to 900 nm including an integrating sphere attachment with using barium sulfonate (BaSO4) as reference. The optical band gap, Urbach energy and optical constants (refractive index, extinction coefficient, real and imaginary parts of the dielectric constant) of the film were determined.

Acknowledgements:

This work was supported by Eskisehir Technical University Commission of Scientific Research Projects under Grant No. 22ADP0278.

## Summary

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**Session Classification:** X-ray applications in various fields