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Characterization of Yttria stabilized Zirconia thin films prepared by Plasma Enhanced MOCVD

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Cubic Yttria Stabilized Zirconia (YSZ) is suitable for a variety of applications due to its interesting properties such as heat resistance and oxygen conductivity. Several techniques as magnetron sputtering, Plasma Enhanced Chemical Vapor Deposition (PECVD) and electrochemical vapor deposition have been tested for the preparation of such materials. Among these techniques, PECVD presents some important advantages as uniform deposition of dense materials under relatively low temperatures and the flexibility of choice from a large number of precursors and substrates. In this work, Plasma Enhanced MOCVD technique is been used to deposit cubic YSZ thin films through mixtures of Y and Zr metallorganic precursors. In addition, oxygen plasma treatment of spin coated YSZ thin films at relatively low temperatures (< 800K) were tested. Both processes took place in a Capacitively Coupled parallel plate plasma reactor and special attention has been given to the choice and the introduction of the precursors in the plasma zone as most of the Y and Zr metallorganic compounds are thermally unstable and oxidizing at rising temperatures. Liquid solutions of the metallorganic precursors (Zr(thd)4 and Y(thd)3) in toluene were used for the Plasma MOCVD and the fraction of Y in Zr was scaled from 8% to 16%. The same solutions were also used for the films prepared by spin coating. Substrates (glass, silicon wafers and stainless steel) were attached at the grounded electrode which could be heated up to 850K. Scanning electron microscopy and Atomic Force microscopy was applied for the determination of films morphology, while X-ray photoelectron spectroscopy and X-ray diffraction was used for the determination of film chemical composition and structure. The films deposited directly by Plasma MOCVD under different conditions (power, temperature) and the spin coated films treated by different oxygen/argon plasmas are compared relative to their morphology and chemical composition.

Keywords
YSZ
PE-MOCVD
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