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Growth of highly oriented monoclinic HfO_2 thin films after Co and Fe doping by pulsed laser deposition S. DHAR, M.S.R. RAO, S.B. OGALE, D.C. KUNDALIYA, S.R. SHINDE, T. VENKATESAN, Center for Superconductivity Research, Department of Physics, University of Maryland, College Park, MD 20742, USA, S.J. WELZ, R. ERNI, N.D. BROWNING, Lawrence Berkeley National Laboratory, NCEM, One Cyclotron Road, Berkeley, CA 94720, USA — Above room-temperature ferromagnetism in undoped and Co doped high-k dielectric HfO_2thin films opens up the possibility for using spin functionality in various new electronic devices. In the present work, we report on the growth of high quality epitaxial HfO_2 thin films stabilized in monoclinic phase after 5% Co or Fe doping at 700-800^{o}C in an oxygen partial pressure of 10^{-4} torr on (001) yttria stabilized zirconia and (001) Si substrates by pulsed laser deposition. On the one hand, pure HfO_2 film did not grow epitaxally under various deposition conditions. On the other hand, the formation of single crystalline phase after Co or Fe doping was confirmed by X-ray analysis. Ion channeling analysis in Co and Fe doped films showed 8-24% minimum yield indicating highly oriented film growth, whereas, a very poor minimum yield was observed in the undoped case. Angular scans showed the HfO_2 to grow in a monoclinic phase with a 9.1 degree tilt with respect to the substrate. High resolution transmission electron microscopy showed very sharp interface while Electron energy loss spectroscopy revealed that Co is in 2+ state indicating the substitution of Co in ionic form into the HfO_2lattice.

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