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Cubic HfO2 Doped with Y2O3 for Advanced Gate Dielectrics by MBE. ZHIKAI YANG, W.C. LEE, PEN CHANG, MOLIN HUANG, YI LIN HUANG, MINGHWEI HONG, Dept. of MSE NTHU Taiwan, C.M. HUANG, C.H. HSU, NSRRC Taiwan, RAYNIEN KWO, Dept. of Phys. NTHU Taiwan, NATL SYNCHROTRON RAD. RES. CTR.TAIWAN COLLABORATION — High κ HfO_2 (κ =20) is currently employed as an alternative gate dielectric replacing SiO_2 in CMOS scaling. There are three known crystal structures of HfO_2, monoclinic, cubic, and tetragonal with varying dielectric constants [1]. Recently we showed HfO_2 films epitaxially grown on GaAs(100) formed the stable monoclinic phase ($\alpha = \gamma = 90$ and $\beta \sim 99$) with the a and b axes aligned with the in-plane GaAs{100}axes resulting in four equivalent domains. This work demonstrates the successful alteration of the crystal structure of $HfO_2$from the lower κ monoclinic phase to the higher κ (κ =30) cubic phase stabilized through epitaxy on GaAs(100) and Si(100) with the aid of Y_2O_3 doping ($\sim$ 20% based on XPS). X-ray diffraction scans on these films clearly indicated the cubic symmetry. Doping Y_2O_3 is also to enhance the thermal stability of amorphous HfO_2. Y_2O_3doping was shown to help raise the re-crystallization temperature of $HfO_2$to becompatible with high temperature processing. [1] X. Zhao et al, PRB **65**, 233106, (2002).

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