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Study of annealing behavior of HfO2 fiber by hyperfine interaction technique.

The thermal behavior of hafnium oxide fiber has been investigated with the help of Time Differential Perturbed Angular Correlation

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poster

Summary

The thermal behavior of hafnium oxide fiber has been investigated with the help of Time Differential Perturbed Angular Correlation (TDPAC) technique along with XRD and SEM measurements. The HfO2 fiber of diameter 6-7µm and density 1.21 gm/cc was neutron-irradiated to produce the indigenous probe 181Hf/181Ta for TDPAC measurement, annealed at different temperatures and then counted on a TDPAC set-up [1] at RT. A typical TDPAC spectrum for HfO2 fiber annealed at 1673K is shown in fig1. TDPAC parameters, shown in table-1, remain almost same in all the cases indicating the structural identity. Only a meager increment in ⊠-values indicates a little loss in crytallinity in the samples annealed at higher temperature. The TDPAC parameters for HfO2 fiber are also in good agreement with that for bulk HfO2. XRD spectra also remain same except a little broadening of the peaks at 1673K. It indicates that the fiber can retain its physical integrity almost intact even at 1673K. SEM measurement of the fiber indicates that the diameter of the fiber is not changed up to 1673K. Hence the HfO2 fiber has high thermal stability and stable lattice structure up to 1673K. The porosity of the material and hence the diffusion-efficiency of the fiber are also not hampered even at 1673K.This indicates the suitability of this material to be used as the target material for Radioactive Ion Beams [2]. However, a small increase in the frequency distribution may be attributed to the minor structural change with temperature. Literature [3] indicates a phase transformation from monoclinic to tetragonal HfO2 taking place above 1443K. However in this present work we could not find any structural change up to 1673K. It implies that either it has not undergone any phase transition or the phase transition is reversible.

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