Chemical Transformation of Crystalline Hafnium Tetrafluoride Studied by Perturbed Angular Correlation Spectroscopy

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The chemical transformation of the trihydrate hafnium tetrafluoride crystal has been studied with varying temperature using the time-differential perturbed angular correlation technique. The 133 – 482 keV γ-γ cascade of ^{181}Ta after the β^--decay of ^{181}Hf has been selected and a four detector BaF_2-BaF_2 coincidence set up has been used for measurements. The crystal was produced by evaporating a solution of $HfF_6{}^{2-}$ complex in HF at room temperature. Contrary to the earlier report, it has been found that the trihydrate hafnium tetrafluoride compound dehydrates directly to HfF_4 without producing any intermediate monohydrate and present results do not support the earlier idea that two water molecules of $HfF_4 \cdot 3H_2O$ are loosely bound. Present investigations exhibit a superheated state for the hafnium tetrafluoride crystal. In dehydrated HfF_4, two different Hf sites have been observed which suggests two different structures for the anhydrous HfF_4.

Key words: Hydrated Hafnium Tetrafluoride; Dehydration Temperature; Time-Differential Perturbed Angular Correlation; Nuclear Quadrupole Interactions.