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## Surface Charge of Rare Earth Phosphate (Monazite) in Aqueous Solutions

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**Abstract:** The surface charge mechanisms of monazite were studied using electrokinetic tests, solution equilibrium calculations, crystal structure characterization, and electrostatic model predictions. The isoelectric point (IEP) of a natural monazite sample was found to occur at pH 6.0. To allow a theoretical study of the surface charge on monazite, fundamental values associated with cerium monazite ( $\text{CePO}_4$ ) were utilized to quantify the isoelectric point (IEP) and point of zero charge (PZC) using solution equilibrium calculations and electrostatic models. The IEP and PZC of the cerium monazite were determined to be equal with a pH value of 7.2. Hydroxyl and hydrogen were found to be potential determining ions and preferential hydrolysis of the lattice ions played a minor role. The findings support the hypothesis that the charge of monazite surfaces in water is a result of protonation/deprotonation reactions. The difference in the IEP values obtained for the natural monazite and cerium monazite along with the wide range of values reported in literature may be partially explained by the amount of carbon dioxide dissolved in solution. When equilibrating with carbon dioxide at  $10^{-3.5}$  atm partial pressure, the IEP of the cerium monazite shifted to a solution pH value of 4.5.

**Keywords:** charging mechanism; monazite; zeta potential; electrokinetic study

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