

Topotaxial replacement of chlorapatite by hydroxyapatite during hydrothermal ion exchange

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ABSTRACT

Exchange of Cl^- by OH^- in synthesized chlorapatite single crystals was investigated under hydrothermal conditions. Hydrothermal treatments were performed at various temperatures from 200 to 500 °C, for intervals between 3 and 96 h in KOH or NaOH solutions. Ion exchange of Cl^- in the chlorapatite crystals was completed at low temperature (500 °C) for a short time (12 h) in 6.25 *M* KOH solution, and resulted in the formation of hydroxyapatite. The rate of ion exchange was accelerated by increasing the reaction temperature and/or concentration of the alkaline solutions. That the converted crystals were single crystals of hydroxyapatite was confirmed by X-ray precession photographs. The hydroxyapatite single crystals that formed from the chlorapatite single crystals by the topotaxial ion exchange under alkaline hydrothermal conditions had a characteristic texture, exhibiting channels on the surfaces and tunnels inside, both along the *c* axis of the crystals. A dissolution and precipitation process is proposed for the ion-exchange reaction conducted under hydrothermal conditions.