

2.3 Chemical Treatment of Fluorite Ores

The three processes described in this section are based upon laboratory and/or small pilot-scale demonstrations. No commercial operations are known. Parts of the processes have not been demonstrated in conjunction with the principal reaction steps and although they are assumed to be feasible, may require verification in particular types of process equipment. The reaction conditions may need to be varied for any particular ore, according to its mineral content.

2.3.1 Pyrohydrolysis

A schematic flow sheet is given in Fig. 3.

Run-of-mine fluorite ore is recovered from stockpile and crushed to pass 10 mm. The crushed ore is reacted with steam at 1,000 to 1,300°C in an externally heated reactor. A rotary kiln should be suitable. The reaction may require a residence time of from 1 to 4 h to achieve 85 to 90% extraction of fluorine.



With some ores the reactivity may be improved by the addition of silica. If the stoichiometric quantity of steam is sufficient to achieve the required fluorine extraction, the off-gases may be simply cooled and anhydrous HF condensed. However, if excess steam is necessary, this will also condense and the condensate will need to be redistilled over concentrated sulphuric acid to produce the anhydrous HF.

In either case, the off-gas from the condensers is passed through a lime scrubber to remove residual HF. Spent lime is recycled to the kiln. Steam required for the reaction is produced by a waste-heat boiler situated in the combustion gas outlet duct. Further heat recovery is achieved by preheating combustion air.