

Design of a Jig for Separating Minerals of Very Similar Densities

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Abstract

Dolomite [$\text{CaMg}(\text{CO}_3)_2$] is an intolerable impurity in phosphate ores, due to its MgO content. In high-dolomite Florida phosphate deposits, the dolomite could, in principle, be separated without any need for crushing and grinding the material by any process that could function at a relatively coarse size. Even though the dolomite and apatite are sufficiently liberated, they have very similar densities with apatite only slightly denser than dolomite, making density separations difficult.

A sample of high-dolomite phosphate from Florida contained dolomite pebbles with a mean density of 2.51 g/cm^3 , and apatite pebbles ranging from 2.55 to 2.78 g/cm^3 . To separate the dolomite from the apatite, a unique laboratory scale jig was constructed that allows for easy alteration of effective jiggling properties. This jig was operated in batch mode with a feed sized to $6.73 \text{ mm} \times 3.36 \text{ mm}$ to examine the effects of key parameters, pulsation rate and jig bed depth. It was found that a pulsation rate of approximately 200 pulses/minute gave the best separation results. A pulsation rate of 100 pulses/minute resulted in incomplete separation of the dolomite and apatite, while a rate of 300 pulses/minute did not show any further improvement over a rate of 200 pulses/minute. Analysis of the jig bed at the conclusion of each test showed that most of the separation occurred in the bottom 1 inch (25 mm) of the jig bed.