

FLOTATION OF APATITE AND REEs AS CO-PRODUCTS FROM A VIETNAMESE SEDIMENTARY PHOSPHATE ORE RICH IN CARBONATE AND FINELY INTERGROWTH

Huu Duong HOANG, Maelgwyn Mineral Services Ltd, Vietnam

d.hoang@hzdr.de

Lucas Pereira, Helmholtz Institute Freiberg, Germany

Martin Rudolph, Helmholtz Institute Freiberg, Germany

Key Words: carbonaceous apatite, rare earth elements (REEs), fine particle flotation, finely disseminated

Vietnamese phosphate deposits are of marine sedimentary origin and one of the largest phosphate rock deposits of Southeast Asia. Lao Cai phosphate reserves have been estimated at about 526 million tonnes with hypothetical reserves of about 2.6 billion tonnes. Froth flotation is considered the most effective process for the beneficiation of phosphate ore, with more than 60 % (140 million tons per year) of the marketable phosphate in the world being processed by flotation. However, for finely disseminated sedimentary carbonaceous phosphate ores, flotation is facing various challenges due to similarities in surface properties of the semi-soluble salt-type carbonate and phosphate calcium minerals. Many processes and reagents have been developed to separate carbonates from carbonaceous phosphate ores, however with limited success. This paper will present the effect of hydrodynamics parameters, particle size, liberation and association on flotation performance using automated mineralogy and machine learning. Also, through a combination of time-resolved dynamic froth analysis (DFA) and automated mineralogy (MLA) the effects governing in the froth with different flotation times have been identified and compared with the entrainment results of existing models. Significantly changing pulp and froth properties with time was found due to decreasing reagent and particle concentrations when processing high-grade ores in lab-scale batch flotation testwork. Furthermore, Lao Cai phosphate ores contain about 200 g/t rare earth elements (REEs) which are enriched by froth flotation via co-flotation of the REEs-bearing apatite that could be considered as a secondary REEs source as the large tonnages of phosphate rock mined and processed annually.