

PRE-CONCENTRATION OF SCANDIUM CONTAINED IN SERPENTINITE BY FALCON CONCENTRATOR

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Abstract

Rare earth metals, namely critical metals, have been in great demand due to their usage in industrial applications and their higher economic return in comparison with the base metals. Scandium, as one of the most critical rare earth element, is used in high technology critical applications, such as military applications, aircraft applications, and solid oxide fuel cells. High prices of its end products and lower rate of current production make this superior metal attractive in terms of both economic and technological developments. Due to scarcity of scandium it has not any single deposit and mainly concentrated as in dispersed state in sc-bearing ore deposits and thus the recovery, namely extraction of scandium from these deposits is challenging. In addition to the lower grade of the scandium bearing deposits, deposition of the scandium in the clayey minerals and also the usage of hydrometallurgical processes in order to recover the scandium, make these processes costly due to the impurities contained in these ores. For these reasons, application of mineral processing techniques to obtain a scandium pre-concentrate by rejecting impurities as much as possible prior to hydrometallurgical treatment become a crucial issue during the processing of these types of ores.

The objective of this study is to investigate the possibility of obtaining a scandium (Sc) pre-concentrate from scandium bearing clayey ore by using enhanced gravity separation, namely falcon concentrator. The motivation of obtaining a pre-concentrate is the preparation of a feed relatively enriched in scandium content in order to increase the efficiency and effectiveness of subsequent hydrometallurgical processes besides decreasing the processing costs. Through the pre-concentration process by falcon concentrator, rejection of gangue minerals that would cause negative impacts during the hydrometallurgical treatment, at the highest possible extent, is also targeted.

In more details, enhanced gravity separation by using falcon concentration was performed on a serpentinite type scandium bearing ore, in order to concentrate sc-bearing clay minerals, namely montmorillonite and nontronite, in the lighter fraction and to concentrate Ca, Mg and Si containing impurity minerals in the heavier fraction. As the result of the performed concentration tests, effects of operating parameters namely centrifugal force and fluidization water pressure were investigated and optimum operational parameters that provide the maximum amount of removal of gangue minerals within the minimum loss of scandium, were determined. As the result of the applied enhanced gravity separation by using falcon concentrator feed material that initially contains 85 ppm Sc, was enriched to 138 ppm at 90.18 % at Sc recovery. In addition to these, 50.24 % of Ca, 26.65 % of Mg, and 20.14 % Si were removed in the heavier fraction namely tailings. Following the evaluation of the results in terms of metallurgical grade and recovery values, both the pre-concentrate and tailings were examined in mineralogical point of view, to investigate the effect of centrifugal separation on scandium bearing serpentinite ore qualitatively.