World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:11, No:05, 2017

Optimization of Titanium Leaching Process Using Experimental Design

Authors : Arash Rafiei, Carroll Moore

Abstract : Leaching process as the first stage of hydrometallurgy is a multidisciplinary system including material properties, chemistry, reactor design, mechanics and fluid dynamics. Therefore, doing leaching system optimization by pure scientific methods need lots of times and expenses. In this work, a mixture of two titanium ores and one titanium slag are used for extracting titanium for leaching stage of TiO2 pigment production procedure. Optimum titanium extraction can be obtained from following strategies: i) Maximizing titanium extraction without selective digestion; and ii) Optimizing selective titanium extraction by balancing between maximum titanium extraction and minimum impurity digestion. The main difference between two strategies is due to process optimization framework. For the first strategy, the most important stage of production process is concerned as the main stage and rest of stages would be adopted with respect to the main stage. The second strategy optimizes performance of more than one stage at once. The second strategy has more technical complexity compared to the first one but it brings more economical and technical advantages for the leaching system. Obviously, each strategy has its own optimum operational zone that is not as same as the other one and the best operational zone is chosen due to complexity, economical and practical aspects of the leaching system. Experimental design has been carried out by using Taguchi method. The most important advantages of this methodology are involving different technical aspects of leaching process; minimizing the number of needed experiments as well as time and expense; and concerning the role of parameter interactions due to principles of multifactor-at-time optimization. Leaching tests have been done at batch scale on lab with appropriate control on temperature. The leaching tank geometry has been concerned as an important factor to provide comparable agitation conditions. Data analysis has been done by using reactor design and mass balancing principles. Finally, optimum zone for operational parameters are determined for each leaching strategy and discussed due to their economical and practical aspects.

Keywords : titanium leaching, optimization, experimental design, performance analysis
Conference Title : ICLPH 2017 : International Conference on Leaching Processes in Hydrometallurgy
Conference Location : Montreal, Canada
Conference Dates : May 11-12, 2017

Open Science Index, Chemical and Materials Engineering Vol:11, No:05, 2017 publications.waset.org/abstracts/71800.pdf