Dispersant Adsorption and Effectiveness during Gravity Separation

Researchers: Howard Haselhuhn, Michael Verbeke

Abstract

The settling behavior of ground hematite-rich iron ore at a pH of 11 was assessed in the presence of aqueous calcium; sodium silicate, sodium tripolyphosphate (STPP), sodium hexametaphosphate (SHMP) and sodium henicosapolyphosphate (Glass-H) inorganic dispersants; and Ethylenediaminetetraacetic acid (EDTA). Without calcium, the inorganic dispersants had no effect on the dispersive stability of the ore. This suggests that the inorganic dispersants do not adsorb to the oxide surfaces at a pH of 11 due to their inability to displace the negatively charged hydroxyl groups at the oxide-water interface. In the absence of calcium, EDTA was found to increase the dispersion of the ore, suggesting EDTA adsorption to hydrated iron oxide without the presence of positively charged surface sites. Calcium was found to lower the dispersive stability of the ore by flocculating fine particles.

In the presence of 20 ppm of aqueous calcium, each dispersant affected the dispersive stability of the iron ore differently. Sodium silicate caused little to no dispersion in the presence of 20 ppm calcium. All of the phosphate based dispersants effectively re-dispersed the ore in the presence of 20 ppm calcium. EDTA caused further flocculation of the ore in the presence of 20 ppm calcium. It has been concluded that inorganic dispersants require positively charged surface sites, such as calcium inner-sphere complexes, to adsorb and cause dispersion of an iron ore pulp at a pH of 11. EDTA only causes dispersion without positively charged surface site. The order of dispersant effectiveness from lowest to highest in the presence of 20 ppm calcium at a pH of 11 was found to be Ethylenediamenetetraacetic acid (EDTA) < sodium silicate < sodium tripolyphosphate (STPP) < sodium henicosaphosphate (Glass-H) < sodium hexametaphosphate(SHMP).