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Depression of Copper-Activated Pyrite by Potassium Ferrate in Copper Ore Flotation Using High Salinity Process Water

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Abstract : High salinity process water (HSPW) is often applied in copper ore flotation to alleviate freshwater shortage; however, it is detrimental to copper flotation as it strongly enhances copper activation of pyrite. In this study, the depression effect of a strong oxidiser, potassium ferrate (K_2FeO_4), on the flotation of copper-activated pyrite was tested to realise the selective separation of pyrite from copper minerals (e.g., chalcopyrite) in flotation using HSPW. The flotation results show that when (K_2FeO_4) was added in the flotation cell during conditioning, (K_2FeO_4) could selectively depress copper-activated pyrite while improving chalcopyrite flotation. The depression mechanism of (K_2FeO_4) on pyrite was ascribed to the significant increase in the pulp potential (E_h), dissolved oxygen (DO) concentration and the amount of ferric oxyhydroxides as a result of ferrate decomposition. In the flotation cell, the high Eh and DO concentration promoted the oxidation of low valency metal species (M^+/Me^{2+}) released from mineral surfaces and forged steel grinding media, and the resultant high valency metal oxyhydroxides $Cu(OH)_2$/$Fe(OH)_3$ together with the ferric oxyhydroxides from ferrate decomposition preferentially precipitated on pyrite surface due to its more cathodic nature compared with chalcopyrite, which increased pyrite surface hydrophilicity and reduced its floatability. This study reveals that (K_2FeO_4) is a highly efficient depressant for pyrite when separating copper minerals from pyrite in flotation using HSPW if dosed properly.

Keywords : copper flotation, pyrite depression, copper-activated pyrite, potassium ferrate, high salinity process water
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