Electron microscope investigations of activated chalcopyrite particles via the FLSmidth® ROL process - DTU Orbit (11/08/2019)

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Because of its unique semiconductor properties, the world’s most abundant copper mineral, chalcopyrite (CuFeS₂), is refractory with respect to atmospheric leaching using traditional acidic ferric sulfate lixivants. FLSmidth® has developed a novel approach manipulating lattice properties of semi-conducting minerals with the benefit of increasing chemical reactivity and dissolution kinetics. In the FLSmidth® Rapid Oxidative Leach (ROL) process, leach kinetics are still further enhanced by combining chemical and mechanical processes with the assistance of a Stirred Media Reactor. Due to the reduction in surface passivation problems associated with atmospheric leaching, this process is typically able to achieve copper recoveries exceeding 95% in 6 h. An important factor contributing to this extraordinary process performance is a mineral preconditioning step (the focus of this study), which uses between 0.1 and 5 mol percent of copper (II) to dope the lattice and thereby “activate” chalcopyrite. Since lattice restructuring can have such a dramatic influence on semiconductor reactivity, the associated physico-chemical phenomena are worth studying. In this regard, we investigate the relationship between chemical activation and deformation of the chalcopyrite crystal lattice through the use of electron microscopy. Although the activation process took only an hour and the extent of conversion was on the order of a few mol%, the lattice was found to be strained throughout the particle. This paper draws some insights into the impact of applying chemical activation as a pretreatment for mechanochemical processes.

**General information**
Publication status: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre, The Hempel Foundation Coatings Science and Technology Centre (CoaST), FLSmidth USA Inc.
Contributors: Karcz, A. P., Damø, A. J., Illerup, J. B., Rocks, S., Dam-Johansen, K., Chaiko, D.
Number of pages: 10
Pages: 12044-12053
Publication date: 2017
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Materials Science
Volume: 52
Issue number: 20
ISSN (Print): 0022-2461
Ratings:
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.83 SJR 0.807 SNIP 1.08
Web of Science (2017): Impact factor 2.993
Web of Science (2017): Indexed yes
Original language: English
Electronic versions:
JMSC_6_27_2017_post_script.pdf. Embargo ended: 28/06/2018
DOIs:
10.1007/s10853-017-1308-y
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review