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改善原地溶浸工艺中矿石破碎质量的力学机理

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摘要: 通过改善矿石的破碎质量, 提高矿堆的渗透性, 使原地溶浸法开采稳固性和渗透性极差的低品位铜镍矿石成为可能。依据矿石中缺陷存在的情况, 应用断裂动力学和损伤力学的观点, 着重分析了爆炸应力波能量加载对矿石破裂、损伤行为产生的影响; 对矿石块体中贮存爆破动能加载, 致使块体产生破裂或损伤的行为进行了探讨。此外, 对浸蚀裂解与作用在爆堆上的地压能在破裂或损伤过程中所起的辅助作用进行了讨论。给出了应用中深孔挤压爆破技术, 原地崩落低品位铜镍矿石, 形成溶浸矿堆的一些相应相关技术参数。分析结果表明: 采用合理的爆破技术, 可以改善应力波和爆破动能的加载条件, 能提高矿石块体的破碎质量及累积损伤程度; 借助于浸蚀裂解与地压能的作用, 可进一步改善堆浸矿石的块体分布, 提高溶浸液与有用组分的接触和被浸出的机会。

关键字: 溶浸采矿; 低品位铜镍矿; 原地爆破破碎

Investigation on improving fragment of low-grade copper-nickel deposits for stope leaching of broken ore

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Abstract: The desired metal could be recovered from low-grade copper-nickel deposits with bad stability and poor permeability by means of improving the fragment of the ore and enhancing the permeability of the broken ore for stope leaching. According to the distribution of nature and explosion-induced flaw in the ore, and the principle in advanced fracture mechanics and damage mechanics, authors mainly analyzed how the loading of explosive stress waves' energy affected the breakage or damage behavior of the ore. Secondly, how the loading of kinetic energy of the fragment with an amount of flying or moving velocity away from in-situ ore body caused the fragment to crush or damage due to the fragment colliding against others during its flying, and the fragment pushing or twisting against others in the stope heap with small compensating room, was investigated. Finally, how to use the auxiliary role in breaking or damaging the fragment in the stope, played by the dissolution of leach solution and the loading of the strata pressure energy exerting on the fragment in the stope, was discussed. The analysis results showed that the reasonable blasting technique, such as fan boreholes blasting with small compensating room, could improve the loading condition of the explosive stress waves' energy and the fragment's kinetic energy against the ore, and was useful to enhance the fragment quality and accumulative damaging index of broken ore in the stope. The dimension distribution of the fragment could be further improved due to the dissolution of leach solution and the loading of the strata pressure energy against the fragment in the

stope. The improvement in the fragment quality and the accumulative damaging index of the broken ore in the stope might enhance the opportunity for the useful mineral components in the broken ore to contact with leach solution and to be leached out. In the paper, some corresponding blasting parameters, using fan boreholes blasting with small compensating room to break the ore in-situ and to construct the stope leaching heap, were given.

Key words: stope leaching of broken ore; low-grade copper-nickel deposits; breaking and damaging ore in-situ by blasting

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