

锌焙砂浸出规律研究

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摘要:本文以广西某地冶炼厂锌焙砂为原料,以硫酸为浸出剂,研究了不同硫酸浓度、不同浸出温度条件下,浸出时间对锌焙砂硫酸浸出过程中锌、铁浸出效果的影响规律;采用XRD分析方法,分析研究了锌焙砂及浸出产品中的物质存在形式。

关键词:锌焙砂;硫酸浸出;铁酸锌

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1 原料性质

锌焙砂取自广西某冶炼厂,原料半定量分析结果见表1,X射线衍射分析结果见表2。

表1 锌焙砂半定量分析结果/%

Table 1 The semi-quantitative analysis results of zinc calcine

ZnO	Fe ₂ O ₃	SiO ₂	SO ₃	Cu	Pb	Al ₂ O ₃	CaO
70.8	18.4	2.5	2.0	1.6	1.2	0.8	0.6
MgO	Mn	Sb	Cd	Sn	As	P ₂ O ₅	Co
0.6	0.5	0.4	0.2	0.2	0.2	0.02	0.01

表2 XRD分析结果/%

Table 2 The results of XRD analysis

红锌矿	锌铁尖晶石	硅锌矿	石英	赤铁矿	铅矾
49	39	6	2	2	2

从表1可以看出,该锌焙砂成分较为复杂,锌、铁含量均较高。从表2可以看出,该锌焙砂以红锌矿为主,占49%,还含有39%的锌铁尖晶石,6%的硅锌矿,2%的石英赤铁矿和铅矾。

2 浸出试验

物料浸出时,浸出剂的初始浓度是影响浸出率的主要因素。延长浸出时间有利于提高有用金属的浸出率。但是,浸出时间过长会降低设备处理能力,增大设备数量,导致基建投资和经营费用增

加^[1-3]。在锌焙砂的浸出过程中,固体质量固定,液固比的改变方式有两种:一是保持硫酸的初始浓度相同,通过改变浸出溶液的质量来改变液固比;二是保持溶液中硫酸的用量相同,通过改变水量的多少来改变液固比^[4-6]。浸出试验以硫酸为浸出剂,重点研究不同硫酸浓度、不同浸出温度条件下,浸出时间对锌、铁浸出的影响规律,并通过XRD分析研究浸出渣中的物质存在形式。浸出试验中液固比为7:1,搅拌速度为400 r/min。

2.1 浸出时间对锌浸出的影响

不同硫酸浓度在不同浸出时间对锌浸出率的影响见图1。

从图1可以看出,硫酸浓度从40 g/L增大到320 g/L,锌的浸出率随着硫酸浓度的增大而增大;在同一浸出时间内,锌浸出率随着浸出温度的升高而增大,在同一浸出温度条件下,随着浸出时间的延长,锌的浸出率不断增大,但在5 min~180 min的浸出时间范围内,锌的浸出率仅提高几个百分点,说明锌焙砂中的ZnO溶解速度快,在较短时间内就能全部溶解,后续锌浸出率的增大是由于ZnSiO₄和Zn₂FeO₄等含锌矿物的溶解。

2.2 浸出时间对铁浸出的影响

不同硫酸浓度在不同浸出时间对铁浸出率的影响见图2。

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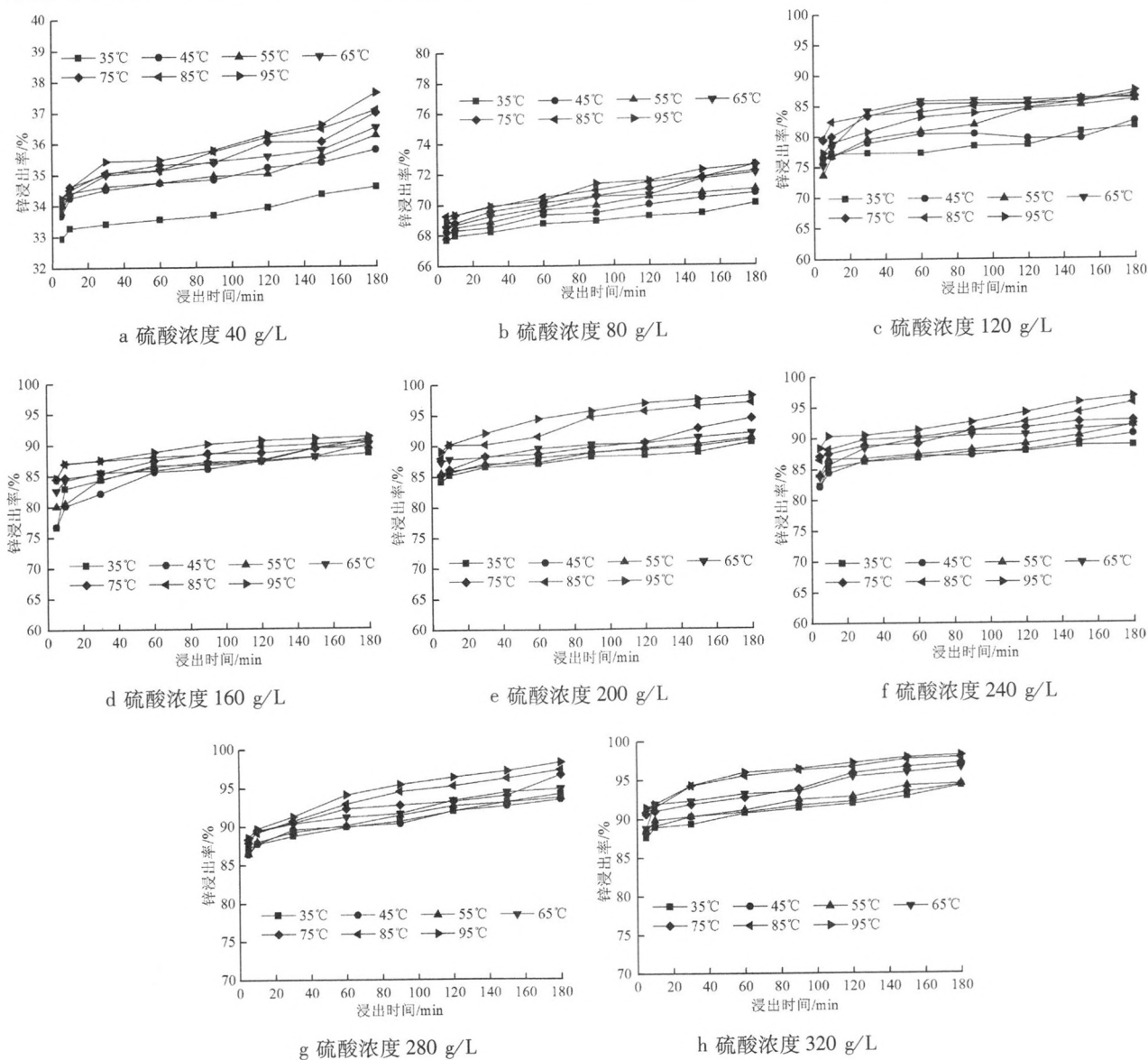
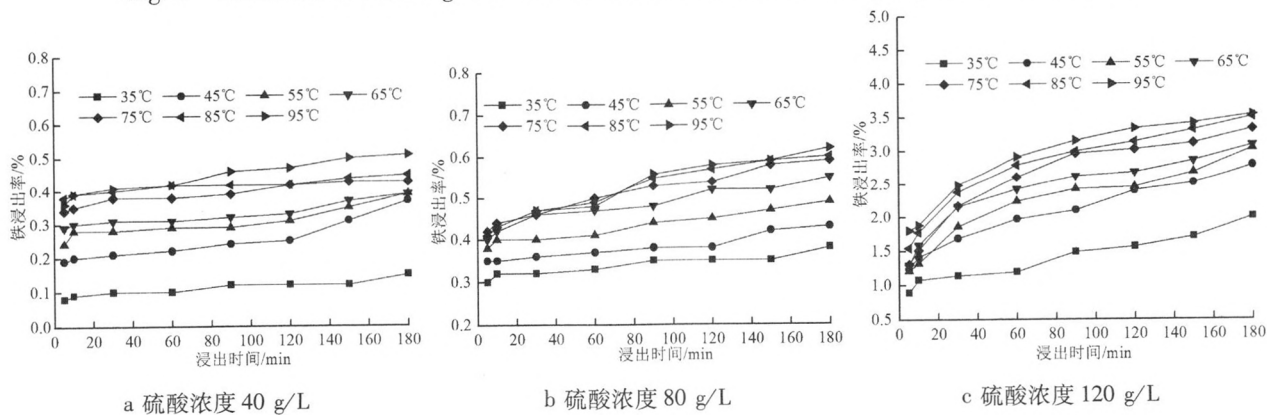


图1 不同硫酸浓度不同时间对锌浸出率的影响

Fig.1 The effect of leaching time and different concentration of H_2SO_4 on Zn leaching rate

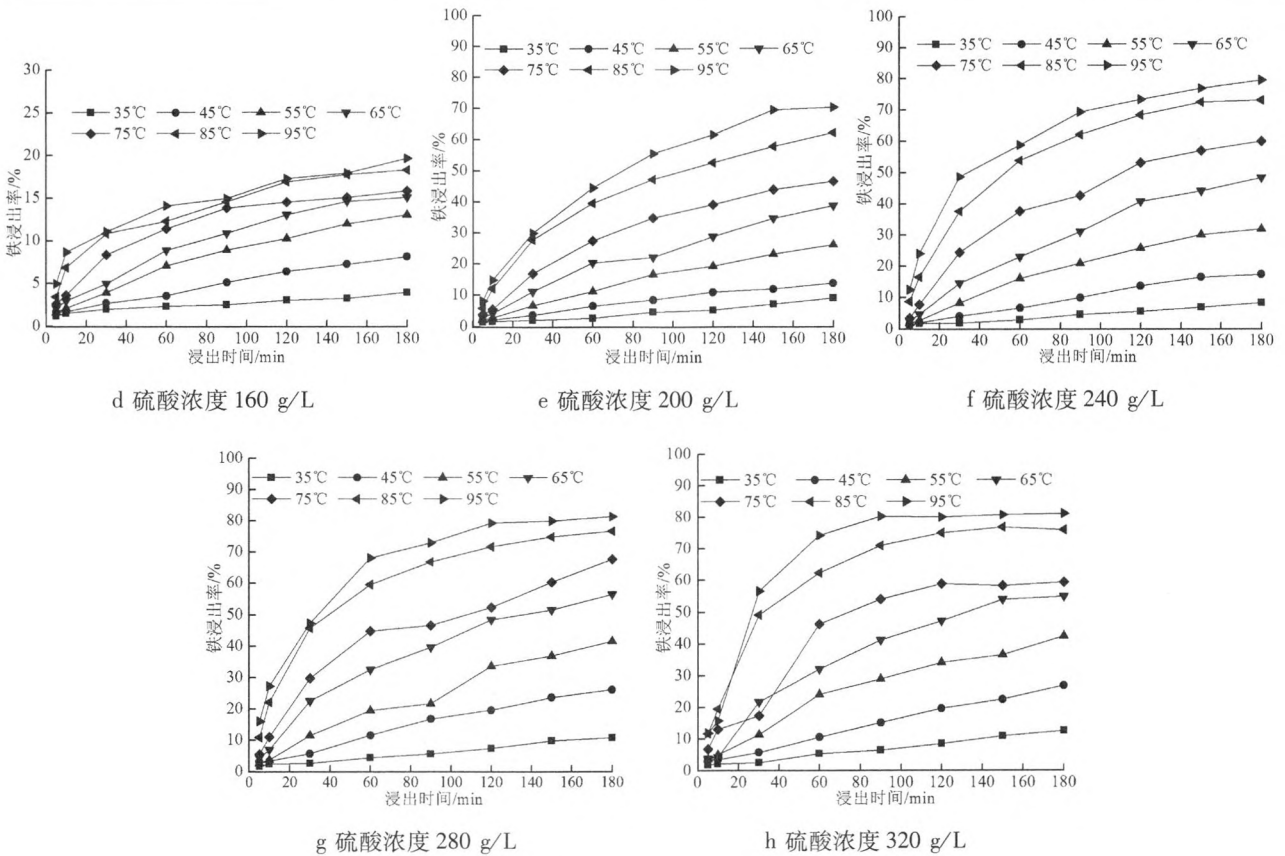


图2 不同硫酸浓度不同时间对铁浸出率的影响

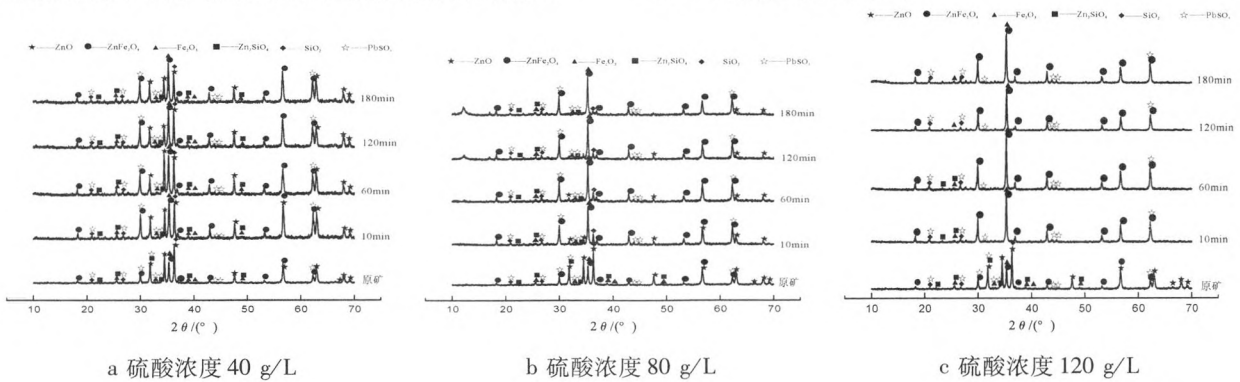
Fig. 2 The effect of leaching time and different concentration of H₂SO₄ on Fe leaching rate

从图2可以看出,浸出初期,铁的浸出速度快,浸出后期,浸出速度慢,且随着浸出温度的增加,铁的浸出率不断增大。与锌浸出率相比,铁浸出率变化较大,其原因可能是锌焙砂中的ZnO较铁矿物溶解速度快,在浸出过程中ZnO优先消耗硫酸并溶解,只有当硫酸用量充足且ZnO溶解完全时,硫酸才开始作用于铁矿物,因此,在硫酸浓度较低(40 ~

80 g/L)的条件下,铁的浸出率很低,基本在1%以下,说明在此酸度条件下,铁矿物并未溶解,继续增大硫酸浓度,铁矿物不断消耗硫酸,进而被溶解破坏,释放出铁,从而使铁浸出率不断增大。

2.3 XRD 分析

不同硫酸浓度不同浸出时间浸出渣与原矿的XRD图谱比较见图3。



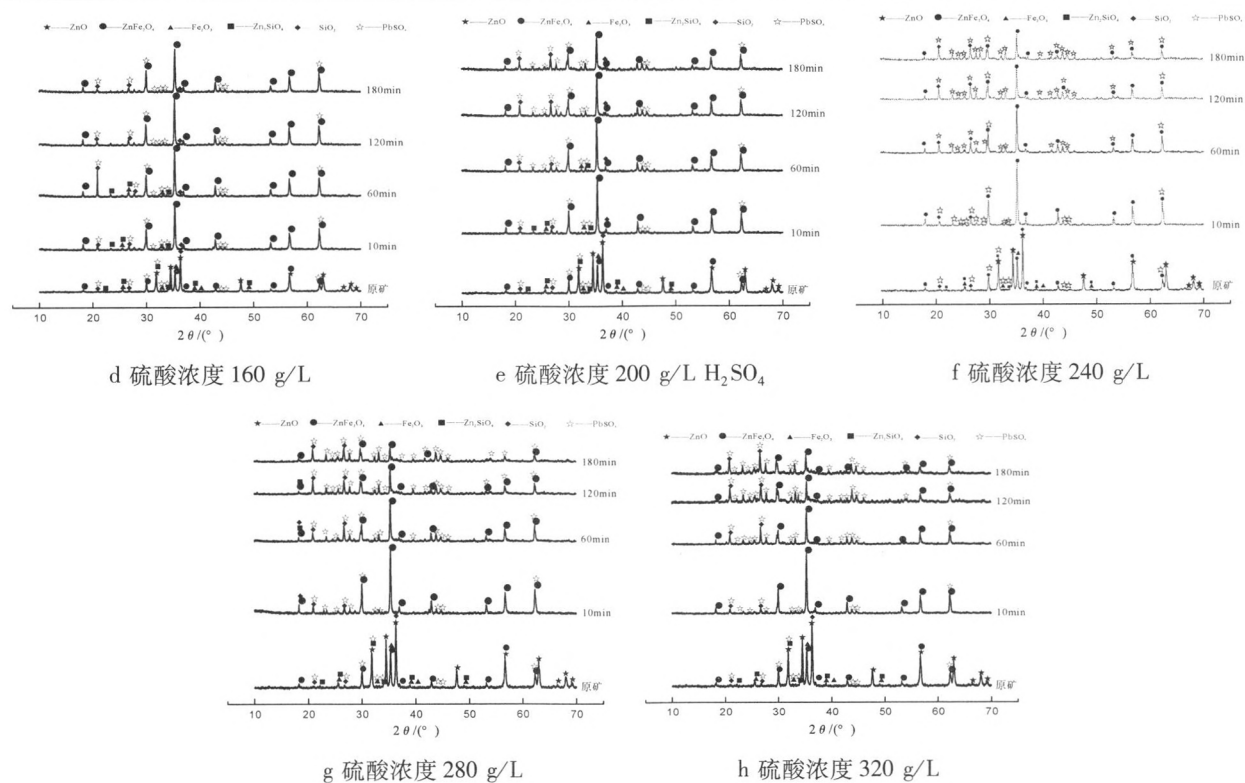


图3 不同硫酸浓度在不同浸出时间浸出渣与原矿的 XRD 图谱比较

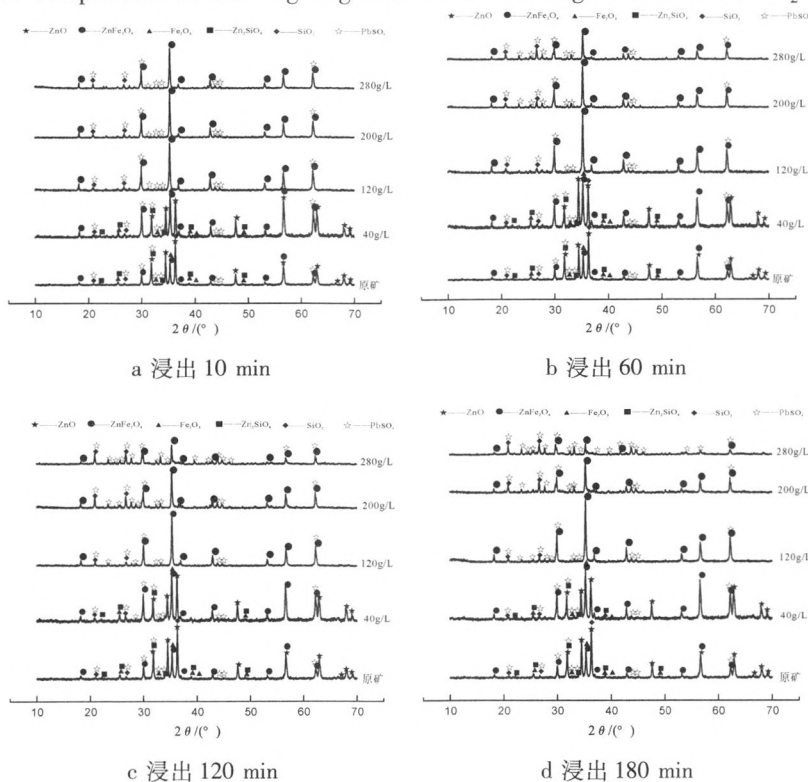
Fig.3 The XRD comparisons of leaching slag in different leaching time at different H_2SO_4 concentration

图4 不同浸出时间在不同硫酸浓度时浸出渣与原矿的 XRD 图谱比较

Fig.4 The XRD comparisons of leaching slag in different sulfuric acid concentration at different time

从图3可以看出,当硫酸浓度小于120 g/L时,浸出渣中ZnO的衍射峰有所减弱甚至消失,Fe₂O₃及ZnSiO₄的部分衍射峰减弱,ZnFe₂O₄、SiO₂及PbSO₄的衍射峰不变,说明此时溶于硫酸的主要是易溶的ZnO矿物。当硫酸浓度大于120 g/L时,不同浸出渣与原矿的XRD图谱差异主要表现在随着硫酸浓度及浸出时间的增大,浸出渣中ZnO的衍射峰消失,Fe₂O₃及ZnSiO₄的衍射峰减弱甚至消失,ZnFe₂O₄的衍射峰减弱,而SiO₂及PbSO₄的衍射峰不变;而不同浸出渣之间的XRD图谱差异主要表现为在同一硫酸浓度条件下,浸出时间小于60 min时,浸出渣中ZnO的衍射峰消失,Fe₂O₃及ZnSiO₄的衍射峰减弱,其他物质的衍射峰不变,而当浸出时间大于60 min后,浸出渣中ZnO、Fe₂O₃及ZnSiO₄的衍射峰均消失,ZnFe₂O₄的衍射峰减弱,其他矿物的衍射峰不变,当酸量充足时,随着浸出时间的延长,Fe₂O₃以及ZnFe₂O₄等难溶的铁矿物开始溶解。当硫酸浓度为120~160 g/L,浸出时间为120~180 min时,浸出渣中未发现ZnO、Fe₂O₃及ZnSiO₄的衍射峰,说明此时锌焙砂中的ZnO、Fe₂O₃及ZnSiO₄溶解消失,浸出渣的主要矿物为铁酸锌,并含有部分二氧化硅和硫酸铅。当硫酸浓度大于200~320 g/L时,ZnFe₂O₄的衍射峰随着浸出时间的延长逐渐减弱,说明硫酸浓度太高,铁酸锌被溶解破坏。

不同浸出时间时不同硫酸浓度浸出渣与原矿的XRD图谱比较见图4。

从图4可以看出,当硫酸浓度低于120 g/L时,XRD图谱的差异主要表现为ZnO的部分衍射峰消失,其他矿物的衍射峰基本不变;当硫酸浓度为120~200 g/L时,不同浸出时间浸出渣之间差别不大,但与原矿相比差别较大,主要表现为ZnO、Fe₂O₃以及ZnSiO₄的衍射峰消失,ZnFe₂O₄的衍射峰有所增强,SiO₂、PbSO₄的衍射峰不变;当硫酸浓度大于200 g/L时,随着浸出时间的延长,ZnFe₂O₄的衍射峰逐渐减弱,说明在此浓度条件下,随着浸出时间的增加,铁酸锌的溶解破坏增强。

3 结 论

(1) 锌的浸出率随着硫酸浓度的增大而增大;在同一浸出时间内,锌浸出率随着浸出温度的升高而增大,在同一浸出温度条件下,随着浸出时间的延长,锌的浸出率不断增大。不过,锌焙砂中的ZnO溶解速度快,在较短时间内就能全部溶解,故浸出后期锌浸出率的增大应该是ZnSiO₄和Zn₂FeO₄等含锌矿物的溶解。

(2) 浸出初期,铁的浸出速度快,浸出后期,浸出速度慢,且随着浸出温度的增加,铁的浸出率不断增大。与锌浸出率相比,铁浸出率变化较大,其原因可能是锌焙砂中的ZnO较铁矿物溶解速度快,在浸出过程中ZnO优先消耗硫酸并溶解,只有当硫酸用量充足且ZnO溶解完全时,硫酸才开始作用于铁矿物。

(3) XRD分析表明,酸量充足时,随着浸出时间的延长,Fe₂O₃以及ZnFe₂O₄等难溶的铁矿物开始溶解。当硫酸浓度大于120 g/L时,ZnO衍射峰消失,Fe₂O₃、ZnSiO₄及ZnFe₂O₄的衍射峰减弱,而SiO₂及PbSO₄的衍射峰不变。在一定硫酸浓度条件下,浸出时间小于60 min时,浸出渣中ZnO的衍射峰消失,Fe₂O₃及ZnSiO₄的衍射峰减弱,其他物质的衍射峰不变;当浸出时间大于60 min时,浸出渣中ZnO、Fe₂O₃及ZnSiO₄的衍射峰均消失,ZnFe₂O₄的衍射峰减弱,其他矿物的衍射峰不变。

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Experimental Study on the Influence of Binder on Briquette Molding

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Abstract: Using Bituminous coal as the research object, the briquette was prepared with different binders. The tests were carried out by single factor. Indicators of performance testing for briquette included cold compressive strength, thermal strength and thermal stability. Then the test data were analyzed. The quality of briquette in relation to binder content was investigated and the forming mechanism of briquette was analyzed. By laboratory briquette forming tests, three kinds of briquette binders were selected: humic acid, starch and sodium bentonite. Theoretical analysis, scanning electron microscopy (SEM) detection and potential testing methods were used. The results showed that these three kinds of binders could make coal particles fully stick together and briquette could have good cold strength, thermal strength, thermal stability. Humic acid and starch are organic binders. Their adhesion and water resistance were better than those of sodium bentonite. But the thermal stability was relatively poor. Sodium bentonite as an inorganic binder had wide sources, low price and thermal stability and thermal strength are better. However the flammability was poor, it increased ash in briquette and reduced the heat of briquette. Therefore, three kinds of adhesive were compounded. At the same time they could improve the cold strength, thermal strength and thermal stability of briquette. It was easy to meet the requirements of industrial use of briquette; It was founded by SEM comparison of three kinds of binders that adding starch as a binder could form more greater amounts of different shapes and symmetrical distribution of crystals and gels. The briquette could reach higher strength; From the size of Zeta potential test to raw coal and different binders of briquette, Zeta potential of briquette for particle surface would also affect the strength of the briquette. The absolute value of the surface Zeta potential of coal particles was the smaller, and the electrostatic repulsion was the smaller, the strength of the briquette was the higher.

Keywords: Binder; Strength; Appearance characteristics; Surface Zeta potential

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Research on Zinc Calcine Leaching Rule

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Abstract: The raw material zinc calcine obtained from a certain smelter in Guangxi was leached by sulfuric acid in this paper. The influence of leaching time on leaching rate of Zn and Fe was studied under different initial sulfuric acid concentration and leaching temperature and the phase composition of zinc calcine and the leaching products were analyzed by the method of XRD.

Keywords: Zinc calcine; Sulfuric acid leaching; Zinc ferrite