

Preparation of Expansive and Self-stressing Sulphoaluminate Cement Using Bauxite Waste

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Abstract In this study, bauxite waste was used instead of bauxite to produce sulphoaluminate clinker. With orthogonal design, the technical parameters for production of sulphoaluminate clinker were studied. Expansive and self-stressing sulphoaluminate cements were prepared using the clinkers produced by varying the added amount of gypsum. The results show that: (1) Using bauxite waste to make sulphoaluminate cement is feasible; (2) The optimum condition for the production of clinker are $N=3.9$, $P=2.8$, $C_m=0.99$ and $T_b=1350^\circ\text{C}$; (3) The physical properties of the prepared cement conform to the standard of self-stressing and expansive cement.

Key words bauxite waste; expansive and self-stressing cement; sulphoaluminate clinker; orthogonal design

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1 Introduction

Grinding sulphoaluminate clinker with different amount of gypsum can produce sulphoaluminate cements. Sulphoaluminate clinker is usually obtained by firing a ground mixture of limestone, bauxite and gypsum at an appropriate temperature; its major phases are C_4A_3S and $\beta-C_2S$.

In a bauxite mining site at Guangxi province, there are a lot of bauxite waste which was deserted. The Al_2O_3 content of the waste approaches about 70%. In this study, bauxite waste was used instead of bauxite to produce sulphoaluminate clinker, and by controlling gypsum addition, expansive and self-stressing cement were prepared. An orthogonal design^[1] was used for the optimization of the four factors (three modules, N , P and C_m ^[2] and firing temperature). The experimental scheme is as shown in Table 1. Expansive and self-stressing cement was controlled by adjustment of mixture proportions between sulphoaluminate clinker and gypsum.

2 Results and discussions

The intensity of specific peak 0.376 nm of C_4A_3S in XRD was the evaluated index. The results are shown

in Table 1. The results show that the influence factor on the quality of clinkers are $N > P > C_m > T$, and the optimum parameters of N , P , C_m were level 1, $N=3.9$, level 3, $P=3.3$, level 2, $C_m=0.99$, respectively. For sintering state and free CaO content in clinkers, the proper sintering temperature is 1350°C . Two levels of P was added^[2], and the optimum technical parameters of $P=3.3$ and 2.8 are the better level.

Using the obtained clinkers prepared the self-stressing and expansive cement by varying the added amount of gypsum. The test results cement with $M=3.0$ ^[1], its all physical properties conform to the standard of self-stressing cement and the properties of cement ($P=2.8$, $M=1.5$) conform to the standard of expansive cement.

3 Conclusion

The research illustrate that using bauxite waste to make sulphoaluminate cement is feasible. With orthogonal design method, the best technical parameters for production of sulphoaluminate cement clinker are obtained, that is $N=3.9$, $P=2.8$, $C_m=0.99$, $T=1350^\circ\text{C}$. The physical properties of the prepared cement conform to the standard of self-stressing and expansive cement.

Tab 1 The Scheme of factoral experimenal and results of tests

Factors		N	P	C _m	T	Results
Test No		Levels				CPS* **
1		1 (3.9) *	1 (4.3)	1 (1.08)	1 (1250℃)	1302
2		1	2 (3.8)	2 (0.99)	2 (1300℃)	1436
3		1	3 (3.3)	3 (0.89)	3 (1350℃)	1610
4		2 (3.0)	1	2	3	1258
5		2	2	3	1	1334
6		2	3	1	2	1286
7		3 (2.0)	1	3	2	782
8		3	2	1	3	952
9		3	3	2	1	1199
Average CPS of tests at same level	K ₁	1449	1114	1180	1275	
	K ₂	1293	1241	1295	1168	
	K ₃	975	1362	1242	1273	
Extreme deviation	R	474	248	115	107	

Note: ① * Figures in parentheses are values of modulus and sintering temperatures responding to the respective level

② ** CPS of 376 nm peak of C₄A₃S

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用废铝渣制备膨胀和自应力硫铝酸盐水泥的研究

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摘 要：通过正交试验设计，研究了用废铝渣替代铝矾土制备硫铝酸盐水泥熟料，调整石膏掺量制备膨胀和自应力水泥。研究表明：①用废铝渣替代铝矾土制备硫铝酸盐水泥熟料是可行的；②最佳熟料煅烧条件为 N= 3.9 P= 2.8 C_m= 0.99 和煅烧温度 T_b=1350℃；③制备的水泥物理性能符合膨胀和自应力水泥国家标准。
关键词：废铝渣；膨胀和自应力水泥；硫铝酸盐水泥熟料；正交设计
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新型纳米纤维膜对地下水中重金属的过滤去除研究

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摘 要：采用扫描电镜表征了氯化聚氯乙烯静电纺丝纳米纤维膜的微观结构特征，并进行了去除地下水中铜、铅、镉等重金属阳离子的过滤试验，包括直接过滤、加土壤过滤、加硅藻土过滤和胶束强化过滤。结果表明，最佳的过滤工艺是胶束强化过滤，其最佳试验条件是 10 层膜过滤和 5mmol/L 的 SDBS 浓度，对铜、铅、镉的去除率分别超过 73%、82% 和 91%。
关键词：纳米纤维膜；重金属去除；地下水；过滤
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