УДК 553.08
doi: 10.18.101/978-5-9793-0883-8-204-205

Activation of Limestone Decomposition

S. Tserenbaljid, Sh. Chadraabal, B. Namjildorj [1]
[1]Department of Physics, School of Applied Science, MUST, Mongolia, e-mail:baljia@must.edu.mn

Abstract

Lime production is very important to building's sector and lime is irreplaceable for the steel industry, it also can be used in the field of construction materials, paints, plastics, and rubber production. Environmental concerns are of paramount importance for these sectors, and innovation includes the use of waste as an alternative raw materials and fuels.

The purpose of the work is to transfer limestone decomposition carbon dioxides into flammable gase state, that removes environmental impact of lime production process and improves the quality of lime produced in Mongolia. The raw materials are power plant's fly ash and small sized limestone of the mining waste. We studied physical and chemical processes occurring during heat treatments of limestone – fly ash system.

The research has shown that is possible to lower heat quantities necessary to limestone decomposition till 50% in comparison with pure calcium carbonate by adding fly ashes till 30% and by treating with 10% NaCl water solutions.

Keywords: Power plants fly ash, thermal analysis, endo and exothermal effects

Активация процесса разложения известняковых пород

С. Цэрэнбалжид, Ш. Чадраабал, Б. Намжилдорж[1]
[1]Кафедра физики, Факультет прикладных наук, МУНТ, Монголия, e-mail: baljia@must.edu.mn

Аннотация

Производство извести очень важно для стройтельства, известь является незаменимой для сталелитейной промышленности, также она может быть использована в области производства, красок, пластмасс и каучука. Экологические проблемы имеют первостепенное значение для этих отраслей, а также инновации включают в себя использование отходов в качестве альтернативного сырья и топлива.

Целью настоящей работы является переход диоксида углерода образованного, разложением известняка в горючее газовое состояние, что устраняет отрицательное воздействие на окружающую среду процесса производства извести и улучшает качество производимой извести в Монголии. Сырем служат летучая зола электростанции и измельченные известняки являющиеся отходом добываюшей промышленности. Мы изучили физические и химические процессы, происходящие при термической обработке системы: известняк – летучая зола.

Показано, что возможно снижение количества теплоты, необходимое для разложения известняка до 50% по сравнению с чистым карбонатом кальция путем добавления летучей золы до 30% и обработки смеси известняка и летучей золы 10%-ным раствором воды NaCl.

Ключевые слова: Летучая зола электростанции, термический анализ, эндо и экзотермические эффекты.

I. Introduction

Lime production is very important to building's sector and lime is irreplaceable for the steel industry, also can be used in the field of construction materials, paints, plastics, and rubber production. Environmental concerns are of paramount importance for these sectors, and innovation includes the use of waste as an alternative raw materials and fuels. The purpose is transferring limestone decomposition carbon dioxides in flammable gase state, that removes environmental impact of lime production process and improves the quality of lime produced in Mongolia. The raw materials are power plant's fly ash and small sized limestone of the mining waste.

II. Experimental

We studied physical and chemical processes occurring during heat treatments of limestone – fly ash system. For laboratory experiments we used Ukhaakhudag Power plants (UPP) fly ashes with 31.7% of unburned carbon content.

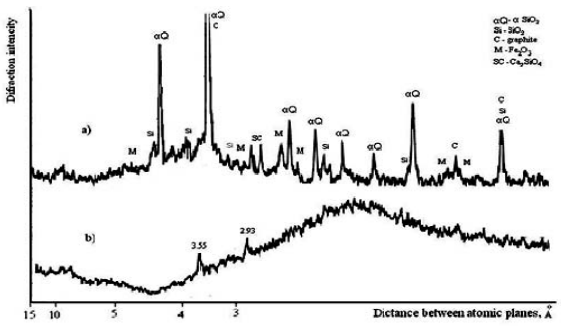

fig.1 X-ray diffraction patterns of UPP fly ashes

a) Fraction with the particle sizes more the 40μm
b) Fraction with the particle sizes less than the 40μm

By the X-ray diffraction analysis method have been determined the presence of quartz (SiO_2), graphite(C), silicon oxide, magnetite (Fe_3O_4), calcium silicate ($CaSiO_4$) in fraction with particle size more than 40μm and only amorphous phasis in the less 40μm particle size fraction.

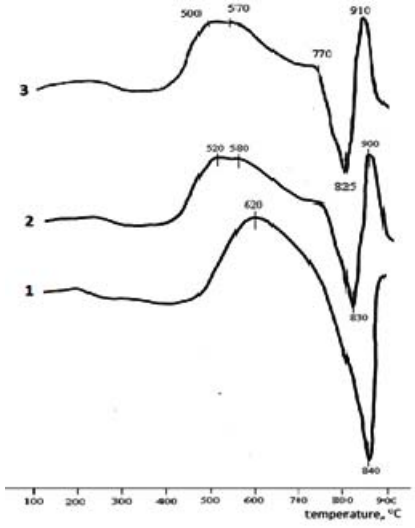

fig.2 Differential temperature curve of UPP fly

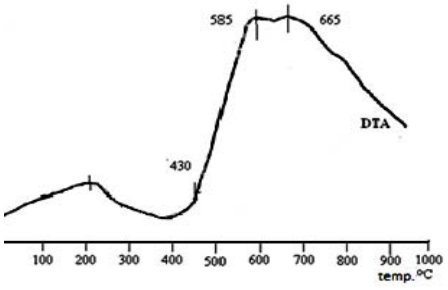

fig.3 Differential temperature curve of limestone- fly ash system: 1-for 30% fly ash; 2- for 30% fly ash mixture treaded with 10% NaCl water solution; 3- for 30% fly ash mixture treaded with 10% NaCl water solution and CO_2 medium.

Thermal analysis was made by using Derivatograph D1500, on DTA curves appeared endothermic effect in the 700-900^{0}C temperature region corresponding to decomposition of pure natural limestone, and exo-thermal effect corresponding to the oxidation of unburned carbon of UPP fly ashes in the 430-1000^{0}C temperature region.

We established previously that, the optimal carbon content for spontaneous burning process of calcium carbonate – graphite systems are about 6-9% [1]. On the basic of this research result it was chosen fly ash contents to be 20-30% in limestone - fly ash mixtures (see Pic.3, curve 1 and Table. 1).

As show in the Fig.3 curve 2 appeared exoeffects at the temperatures 520^{0}C, 580^{0}C and 900^{0}C and the endoeffects area corresponding to the $CaCO_3$ decomposition, decreases in comparison with curve 1.

Table 1. Thermal characteristics of Limestone-Fly ash system

Fly ash,%	Temperature of thermal effects, ^{0}C		Heat quantity	
	Exo	Endo	kJ	Relative
0	-	900	1,575	1
10	580	880	1,570	0,99
20	600	870	1,560	0,99
30	600	840	1,200	0,76
30 (10% NaCl)	520, 580, 900	830	787,5	0,50
30 (10% NaCl) (CO_2)	500, 570, 770, 910	825	708,75	0,45

Conclusion

1. It was established that UPP fly ash has higher weight losses during the burning processes which is connected with oxidation reaction of carbons contained in fly ashes. Therefore, this kind of fly ashes can be used effectively for producing high quality lime.
2. It was shown that the important role plays right selection of mineralizers and burning medium in intensifying limestone decomposition processes using effectively heat energy of limestone-fly ashes systems.

References

1.Tserenbaljid S., Chadraabal Sh., Namjildorj B.and Budsuren J. //To the Problem of Development of the Green Technology for Obtaining the High Activity CaO Oxides / IFOST-2013, 8th International forum on (Vol 1), P. 247-250, ISBN: 978-1-4799-0931-5

2.Obraztsov D.B., Salamekh Kh.Kh., Issledovanie na derivatografh prosessa uglerodnoggo nanomateriala, Sovermennie naukemkie technologii, №10, 2007, Tambov, Russia