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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم





شبكة المعلومات الجامعية

# جامعة عين شمس

التوثيق الالكتروني والميكرو فيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأفلام قد اعدت دون أية تغيرات



يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of  
15 – 25c and relative humidity 20-40 %



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بالرسالة صفحات

لم ترد بالأصل





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بعض الوثائق

الأصلية تالفة

# **Mineralogical and Chemical Studies On Some Raw Materials And Their Impact On Cement Industry**

By

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M.Sc. Geology

To

Geology Department

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For

The Degree of

Doctor of Philosophy

in Geology

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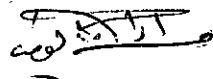
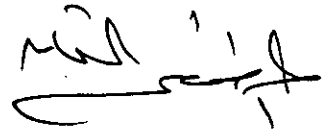
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## Abbreviations

### Cement Chemist notation

A	=	Al <sub>2</sub> O <sub>3</sub>	M	=	MgO
C	=	CaO	N	=	Na <sub>2</sub> O
$\bar{C}$	=	CO <sub>2</sub>	S	=	SiO <sub>2</sub>
F	=	Fe <sub>2</sub> O <sub>3</sub>	$\bar{S}$	=	SO <sub>3</sub>
K	=	K <sub>2</sub> O	P	=	P <sub>2</sub> O <sub>5</sub>

C <sub>3</sub> S	3 CaO. SiO <sub>2</sub>
C <sub>2</sub> S	2 CaO. SiO <sub>2</sub>
C <sub>3</sub> A	3 CaO. Al <sub>2</sub> O <sub>3</sub>
C <sub>4</sub> AF	4 CaO. Al <sub>2</sub> O <sub>3</sub> . Fe <sub>2</sub> O <sub>3</sub>
C <sub>2</sub> F	2 CaO. Fe <sub>2</sub> O <sub>3</sub>
C <sub>6</sub> A <sub>2</sub> F	6 CaO. 2 Al <sub>2</sub> O <sub>3</sub> . Fe <sub>2</sub> O <sub>3</sub>





## Definition of some terms

- Activation energy ( $E_a$ ) : is the energy required for the decomposition of the carbonates into oxides and carbon dioxide (Kcal/Mole).
- Alite phase : is one of the major phases in the produced clinker, composed of tricalcium silicate ( $3 \text{ CaO} \cdot \text{SiO}_2$ ). It is expressed by the formula  $\text{C}_3\text{S}$ . It is responsible for the early strength of cement.
- Alkalies : is the summation of the  $\text{Na}_2\text{O}$  and  $0.659 \text{ K}_2\text{O}$ .
- Alumino-ferrite phase : It is one of the major phases in the produced clinker, composed of tetracalcium alumino-ferrite ( $4 \text{ CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$ ). It is expressed by the formula ( $\text{C}_4\text{AF}$ ).
- Aluminate phase : is one of the major phases in the produced clinker, composed of tricalcium aluminate ( $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ ). It is expressed by the formula ( $\text{C}_3\text{A}$ ). It is responsible for the setting properties.
- Apparent porosity : is the proportion of the open pores of the body to its volume expressed as a percentage.  
Apparent porosity =  $\frac{\text{bulk density} \times \text{water absorption}}{\text{bulk density}}$
- Belite phase : is one of the major phases in the produced clinker, composed of dicalcium silicate ( $2 \text{ CaO} \cdot \text{SiO}_2$ ). It is expressed by the formula ( $\text{C}_2\text{S}$ ). It is responsible for the late strength.
- Blaine : is the specific surface area of cement expressed by  $\text{cm}^2/\text{g}$ .
- Bulk density : is the proportion of weight of the body to its volume including the pores ( $\text{g}/\text{cm}^3$ ).

- Burnability factor (B.F.) : is a guideline for the kiln feed to show if a given clinker is easier or harder to burn
  - \*  $B.F. = L.S.F. + 10. SR - 3 (MgO + \text{alkalies}) \quad * 100 - 120$
  
- Burnability index (B.I.) : is an indicator of the ease of burring for a given clinker. The high is the index number, the harder is the clinker to burn.
  - \*  $B.I. = \frac{C_3S}{C_4AF + C_3A} \quad * 2.6 - 4.5$
  
- Compressive strength is the load at which failure occurs to the unit area of a specimen ( $kg/cm^2$ ).
  
- D.T.A. : differential thermal analysis used in this research for the determination of the decarbonation temperature of the carbonate samples.
  
- Ettringite : is a result of the reaction between the tricalcium aluminate ( $C_3A$ ) and gypsum ( $Ca\ So_4, 2\ H_2O$ ), its chemical formula is  $3\ CaO. Al_2O_3. 3\ Ca\ So_4. 32\ H_2O$ .
  
- Free lime percent ( $CaO_F\%$ ) is the percent of the uncombined lime in the clinker.  $CaO_F$  should be  $\pm 1\%$
  
- Glomeroblastic texture : ill formed inequigranular, xenomorphic alite crystals and clustering semirounded belite.
  
- Liquid phase percent ( $Lc\%$ ) : is the percentage of the liquid phase when the clinker is burnt at a temperature of  $2642^\circ F$ .  $Le\ 24 \pm 4\%$ .
  - $Lc\% = 3Al_2O_3 + 2.28\ Fe_2O_3 + K_2O + Na_2O + MgO$  when  $A.M. > 1.38$ .
  
- Loss on ignition (L.O.I.) : is usually determined by tests in a laboratory furnace. It is also determined from the chemical analysis of the kiln feed.
  - $L.O.I. = 0.44\ CaCO_3 + 0.524\ MgCO_3 + H_2O + \text{organic matter}$ .

- Minimum burning temperature : The temperature which is fair enough for the formation of alite phase in clinker burning.
- Monodblastic texture : ideomorphic well formed prismatic, tabular, enhederal crystals of well distributed alite and rounded belite with little clustering or nesting and well distribution of the aluminate and ferrite phases over the entire clinker volume.
- Rate of decomposition of carbonates : is the number of moles of carbonates which decompose into oxides and carbon dioxides per minute.
- Raw mix reactivity : is defined by the rate of chemical reactions among the present constituents of the raw mix attained on burning it at a certain temperature for a certain time.

$$R_m = \frac{L_c}{R_c \cdot R_q \cdot C_3 S_{\max}} \times \frac{1}{S}$$

- Relative grindability index (w) : is the power required to grind a piece to a certain blaine during a certain time.

$$w = \frac{13.49}{10^4 \frac{ES}{\text{cm}^2 / \text{g}}}$$

- Specific gravity : is the proportion between the weight and volume of the mass without the pores.
- Total carbonates (Tc) : are usually determined analytically by the acid- alkali titration method. They can also be calculated from the raw meal analysis.

$$T_c = 1.784 \text{ CaO} + 2.09 \text{ MgO}$$



- Volatiles : these are essentially compounds of potassium, sodium, sulphur and chlorine. They occur in the vapour phase as well as in the condensed phases.
- Water absorption : is the amount of water absorbed by the tested piece when completely saturated.
- X.R.F. : X-ray fluorescence analysis used in this research for the quantitative determination of the major, minor and trace elements of the raw materials, raw meal and the produced clinker.
- X.R.D. : X-ray diffraction analysis used in this research for the qualitative determination of the minerals constituting the raw materials and the the produced clinker.