

Ain Shams University  
Faculty of Science  
Chemistry Department



## **Effect of Some Novel Polymers on the Physico-Chemical Properties of Blended Cement Pastes**

A Thesis submitted for partial fulfillment of  
Ph.D. Degree of Science in Chemistry

By

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Ain Shams University, 2016

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**2018**

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا

إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ

الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

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TO  
THE SOUL OF MY FATHER

## **ABSTRACT**

In this study, the mechanical, physico-chemical, fire resistance and rheological properties of blended cement pastes were improved using three different admixtures namely; phenol formaldehyde sulfonilate (SI), and low phenol content phenol formaldehyde sulfonilate (SII) and sikament-TG (TG). The mechanical properties for all cement pastes containing different doses of these admixtures at various curing time were investigated by using compressive strength test. The hydration kinetics was studied by determining chemically combined water, degree of hydration and gel/space ratio. The fire resistance tests were studied by measuring the weight loss percentages and compressive strength values for some selected pastes (optimum dose) at each firing temperature. The phase composition and microstructure of the formed hydrates were examined using scanning electron microscopy (SEM), X-ray diffraction (XRD) and different thermal analysis techniques. The rheological properties were performed by using Mini-slump and Rheometer test. The results showed that, the decreasing in the water of consistency caused by adding these admixtures, leads to the decreasing in the total porosity, which enhancing the mechanical properties. The doses of 0.25% TG, 0.50% SI and 1.00% SII were the optimum doses. Moreover, in case of air cooling, the compressive strength of the hardened pastes admixed with the optimum doses increased by firing the specimens up to 500°C, then decreased by firing the specimens at temperatures up to 700°C, but still higher than the compressive strength at room temperature. The compressive strength in case of water cooling is lower than air cooling due to formation of

microcracks. The repulsion and steric hindrance effect of these admixtures improve the rheological behavior of the cement slurries.

Keywords:

Blended cement pastes, Mechanical, Physico-chemical, Rheology, Chemical admixtures, Compressive strength, Combined water, Degree of hydration, Gel/space ratio, Fire resistance, Thermal Analysis, X-ray diffraction (XRD), Scanning electron microscopy (SEM), Mini-slump test and Rheometer test.

## CONTENTS

	<b>Page</b>
Acknowledgment.....	<i>i</i>
Abstract.....	<i>iii</i>
List of Tables .....	<i>ix</i>
List of Figures.....	<i>xvii</i>
<b>CHAPTER I</b>	
<b>INTRODUCTION AND OBJECT OF INVESTIGATION.</b>	
I.A. Introduction.....	1
I.A.1. Introductory Remarks.....	1
I.A.1.a. Cement.....	1
I.A.1.b. Silica fume.....	6
I.A.1.c. Chemical admixtures.....	11
I.A.1.d. Fire resistance.....	14
I.A.1.e. Rheology of slurries.....	16
I.A.2. Literature Survey.....	23
I.B. Object of Investigation.....	55
<b>CHAPTER II</b>	
<b>MATERIALS AND EXPERIMENTAL TECHNIQUES.</b>	
II.A. Materials.....	58
II.A.1. Cement and silica fume.....	58
II.A.2. Admixtures.....	59
II.A.2.a. Phenol formaldehyde sulfanilate (SI).....	59
II.A.2.b. Low phenol content phenol formaldehyde sulfanilate (SII).....	59
II.A.2.c. Sikament-TG (TG).....	60
II.B. Experimental Techniques.....	61
II.B.1. Preparation of Admixed Cement Pastes.....	61
II.B.1.a. Mixing .....	61
II.B.1.a.1. Preparation of dry mixture.....	61

II.B.1.a.2. Preparation of the cement pastes.....	61
II.B.1.b. Molding.....	61
II.B.1.c. Curing.....	62
II.B.2. Methods of Evaluation of the Physico-chemical and Mechanical Measurements.....	62
II.B.2.a. Water of consistency.....	62
II.B.2.b. Compressive strength .....	62
II.B.2.c. Stopping of the hydration.....	63
II.B.2.d. Chemically combined water content.....	63
II.B.2.e. Degree of Hydration.....	64
II.B.2.e.1. From chemically-combined water.....	64
II.B.2.e.2. From thermal analysis techniques.....	65
II.B.2.f. Gel/space ratio.....	65
II.B.2.g. Fire resistance studies.....	66
II.B.2.g.1. Weight loss test.....	66
II.B.2.g.2. Compressive strength test.....	66
II.B.2.h. Rheological Measurements.....	67
II.B.2.h.1. Mini-slump test.....	67
II.B.2.h.2. Rheometer test.....	68
II.B.3. Phase Composition Analysis.....	69
II.B.3.a. Thermal analysis techniques.....	69
II.B.3.b. X-ray Diffraction Analysis (XRD).....	69
II.B.3.c. Scanning Electron Microscopy (SEM).....	69
<b>CHAPTER III</b>	
<b>RESULTS AND DISCUSSION.</b>	
<b>PART I: Physico-chemical and Mechanical Properties of the prepared cement pastes...</b>	70
III.A. Characterization of superplasticizers.....	70
III.B. Standard water of consistency.....	73
III.C. Effect of the used admixtures on the mechanical	76

properties of the hardened cement pastes.....	
III.D. Effect of the used admixtures on the hydration kinetics of the hardened cement pastes.....	87
III.D.1. Chemically combined water content.....	87
III.D.2. Degree of hydration.....	94
III.D.2.a. Estimation of the degree of hydration from chemically combined water.....	95
III.D.2.b. Estimation of the degree of hydration from thermal analysis techniques.....	100
III.D.3. Gel/space ratio (x).....	118
III.E. Phase composition and microstructure of hardened cement pastes.....	124
III.E.1. Phase composition of the various hardened cement pastes.....	124
III.E.2. Morphology and microstructure of the various hardened cement pastes.....	128
<b>PART II: Fire Resistance Properties of Cement pastes.....</b>	<b>135</b>
III.A. Effect of elevated temperatures on the weight loss percentage.....	135
III.B. Differential scanning calorimetry (DSC).....	137
III.C. Effect of elevated temperatures on the compressive strength of the cement pastes containing optimum dose of different admixtures.....	139
III.C.1. Compressive strength of the cement pastes after slow cooling process.....	140
III.C.2. Compressive strength of the cement pastes after fast cooling process.....	144
III.D. Phase Composition and Microstructure of hardened cement Pastes at elevated temperatures.....	148
III.D.1. Phase composition of the various hardened cement pastes at elevated temperatures.....	148

III.D.2. Morphology and microstructure of the various hardened cement pastes.....	154
<b>PART III: Rheological Properties of Cement Pastes.....</b>	<b>162</b>
III.A. Mini-slump test.....	163
III.B. Rheometer test.....	167
III. B. 1. Effect of applied shear rate on the rheological properties (shear stress values) of SF blended cement slurries containing different doses from different admixtures.....	167
III.B.1.a. Rheological behavior of different cement slurries at room temperature.....	167
III.B.1.b. Rheological behavior of different cement slurries at elevated temperatures.....	174
III.B.2. Application of different rheological models.....	185
III.B.2.a. Bingham plastic rheological model (1916)...	187
III.B.2.b. Herschel–Bulckley model (1926).....	191
III.B.2.c. Modified Bingham model (1985).....	198
III.B.2.d. Vipulanandan rheological model (2014).....	204
III.B.3. Effects of different types of admixtures at different temperatures on yield stress.....	210
III.B.4. Effect of different types of admixtures at different temperatures on the shear thinning/ thickening behavior of cement slurries.....	216
<b>CHAPTER IV</b>	
<b>SUMMARY AND CONCLUSIONS.</b>	
Summary and Conclusions	225
<b>REFERENCES</b>	<b>231</b>
<b>ARABIC SUMMARY</b>	

**LIST OF TABLES**

		Page
Table (1)	The main raw materials used in cement production	2
Table (2)	The composition of the cement clinker	2
Table (3)	Typical chemical and physical properties of silica fume	6
Table (4)	physical and chemical contribution of SF and effect of them in enhancing the mechanical properties	7
Table (5)	Why SF used as a mineral admixture in concrete?	8
Table (6)	The chemical composition of the used OPC and SF	58
Table (7)	Classification of water that present in hardened cement pastes	63
Table (8)	Water/cement ratios and water reduction (%) of the cement pastes containing different doses of the used admixtures as well as control sample	74
Table (9)	Compressive Strength values of the various cement pastes made by using different doses of TG at various ages of hydration	76
Table (10)	Compressive Strength values of the various cement pastes made by using different doses of SI at various ages of hydration	77
Table (11)	Compressive Strength values of the various cement pastes made by using different doses of	77

	SII at various ages of hydration	
Table (12)	The chemically combined water ( $W_n$ , %) content values of blended cement pastes made by using different doses of (TG) at various ages of hydration	87
Table (13)	The chemically combined water ( $W_n$ , %) content values of blended cement pastes made by using different doses of (SI) at various ages of hydration	88
Table (14)	The chemically combined water ( $W_n$ , %) content values of blended cement pastes made by using different doses of (SII) at various ages of hydration	88
Table (15)	Values of the degree of hydration ( $\alpha$ ) of the hardened cement pastes made by using different doses (TG) pastes at various ages of hydration	96
Table (16)	Values of the degree of hydration ( $\alpha$ ) of the hardened cement pastes made by using different doses (SI) pastes at various ages of hydration	96
Table (17)	Values of the degree of hydration ( $\alpha$ ) of the hardened cement pastes made by using different doses (SII) pastes at various ages of hydration	97
Table (18)	The percentage of the total weight loss values for the cement pastes made by using best doses of different admixtures as well as the control pastes at various ages of hydration	106
Table (19)	The peaks area values resulting from analysis	110