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**Technical Notes on Geopolymer  
Binders: Laboratory Experiments  
Regarding Different Effects  
Geopolymer Camp 2017**

# Outlines

## ➤ Materials

- Fly Ash
- Metakaolin
- Slag (GGBS)

## ➤ Experimental Notes: Heat curing or room temperature ?

## Materials : Fly Ash

Kimyasal Analizler <i>Chemical Composition</i>	Birim <i>Unit</i>	Sonuçlar <i>Results</i>	Deney Metodu <i>Method of Test</i>
* SiO <sub>2</sub> Silisium Oxide	%	54,08	XRF METOT
* Al <sub>2</sub> O <sub>3</sub> Aluminium Oxide	%	26,08	XRF METOT
* Fe <sub>2</sub> O <sub>3</sub> Iron Oxide	%	6,681	XRF METOT
* CaO Calcium Oxide	%	2,002	XRF METOT
* MgO Magnesium Oxide	%	2,676	XRF METOT
* SO <sub>3</sub> Sulphur Three Oxide	%	0,735	XRF METOT
* Na <sub>2</sub> O Sodyum Oxide	%	0,791	XRF METOT
* K <sub>2</sub> O Potasium Oxide	%	4,537	XRF METOT
* Cl Chlorine	%	0,092	XRF METOT
Toplam Fosfat / Total Phosphate	%	0,260	XRF METOT
Çözülebilir Fosfat / Soluble Phosphate	mg/kg	0,8107	TS EN 450-1
Serbest CaO Free CaO	%	0,11	TS EN 451-1
Reaktif SiO <sub>2</sub>	%	40,23	TS EN 197-1
Reaktif CaO	%	***	TS EN 197-1
*Toplam Alkali (Na <sub>2</sub> O+0,658*K <sub>2</sub> O)	%	3,78	XRF METOT
* Kızdırma Kaybı L.O.I	%	1,36	TS EN 196-2
45 µm elek üzeri Residue on	%	25,09	TS EN 451-2
* Özgül Ağırlık Specific Gravity	g/cm <sup>3</sup>	1,96	İÇ METOT
* Hacim Genleşmesi Soundness-Le Chatelier	mm	1,0	TS EN 196-3
* Aktivite İndeksi 28 günlük	%	77,6	TS EN 196-1
* Aktivite İndeksi 90 günlük	%	90,2	TS EN 196-1

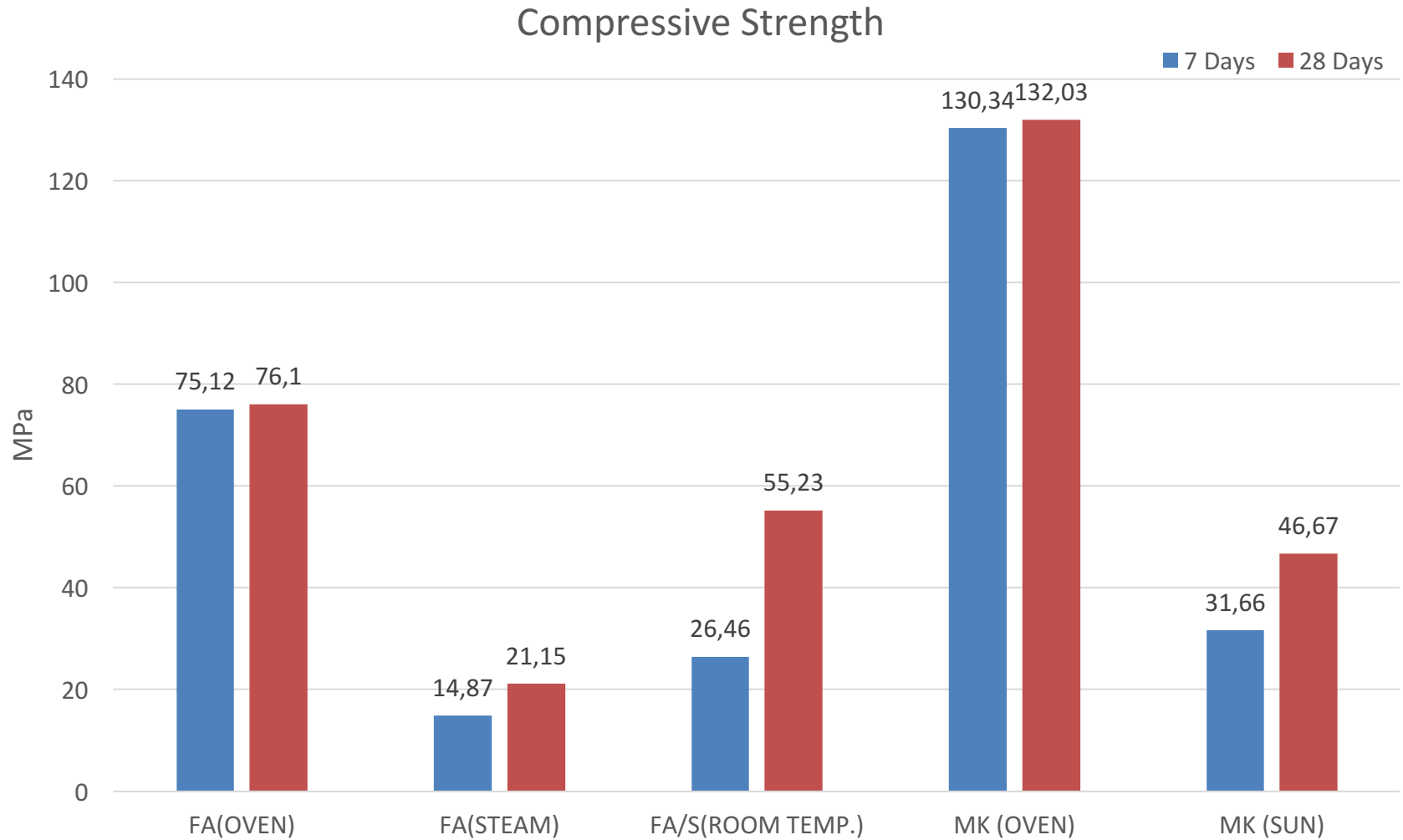
# Materials : Metakaolin

1. Chemical analysis, %	METAKAOLIN
SiO <sub>2</sub>	56,10
Al <sub>2</sub> O <sub>3</sub>	40,23
Fe <sub>2</sub> O <sub>3</sub>	0,85
TiO <sub>2</sub>	0,55
CaO	0,19
MgO	0,16
K <sub>2</sub> O	0,51
Na <sub>2</sub> O	0,24
L.o.i 1000 °C	1,10
2. Mineralogical composition /XRD Siemens D 500/, %	quartz ~ 8
	mica ~ 4
	kaolinite - traces
	amorphus phase ~ 87
	others ~1
3. Wet residue on sieve 45 µm, %	0,70
4. PSD - Sedigraph 5120, %	
< 45 µm	99,3
< 32 µm	99,0
< 20 µm	96,9
< 10 µm	89,1
< 7 µm	81,1
< 5 µm	71,9
< 2 µm	45,8
< 1 µm	32,2
< 0,5 µm	18,4
D50, µm	2,395
5. Pozzolanic index /Chapelle test/, mgCa(OH) <sub>2</sub> /g	1359

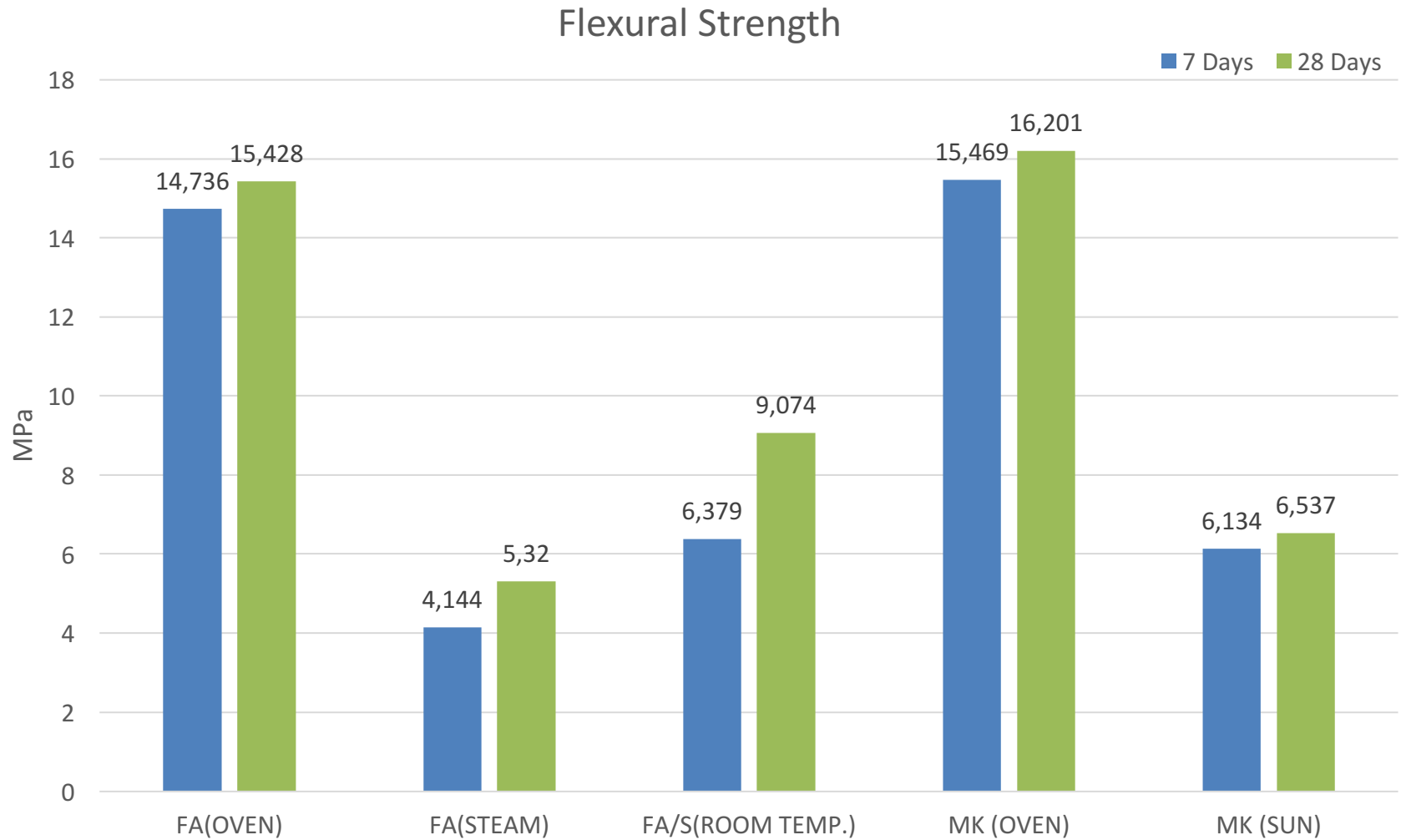
# Materials : Slag (GGBS)

KİMYASAL ANALİZLER (%) (CHEMICAL ANALYSIS)	Standart (Standard)	Analiz Sonucu (Analysis Result)	FİZİKSEL ANALİZLER (PHYSICAL ANALYSIS)	Standart (Standard)	Analiz Sonucu (Analysis Result)		
	SiO <sub>2</sub>			40,55	Özgül Ağırlık (Specific Gravity)	gr/cm <sup>3</sup>	2,91
Al <sub>2</sub> O <sub>3</sub>		12,83	Su İhtiyacı (Water Demand)	%			
Fe <sub>2</sub> O <sub>3</sub>		1,10	Priz Başl. (In. Set. Time)	Referans (Reference)	Dakika (minute)	160	
CaO		35,58	Karışım (Mixture)	Dakika (minute)	max. (2xRef.)	203	
MgO	max. 18,00	5,87	Genleşme (Soundness)	mm			
SO <sub>3</sub>	max. 2,50	0,18	İncelik (Fineness)	Özgül Yüzey (Specific Surface)	cm <sup>2</sup> /gr	min. 2750	5104
Na <sub>2</sub> O		0,79		Elek Üstü (Residue)	45 µ	%	
K <sub>2</sub> O		0,68	Hidrasyon Isısı (Hydration Heat)	cal/gr			
Toplam Alkali (Total Alkali)		1,23	MİNERALOJİK KOMPOZİSYON (MINERALOGICAL COMPOSITION)	C <sub>3</sub> S	%		
Cl <sup>-</sup>	max. 0,1000	0,0143		C <sub>2</sub> S	%		
S <sup>2-</sup>	max. 2,00	0,68		C <sub>3</sub> A	%		
Cr <sup>+6</sup> ppm				C <sub>4</sub> AF	%		
TiO <sub>2</sub>		0,75		2C <sub>3</sub> A+C <sub>4</sub> AF	%		
Mn <sub>2</sub> O <sub>3</sub>		0,58		Kireç Standardı (Lime Saturation Factor)	%		
Kızdırma Kaybı (Loss on Ignition)	max. 3,00	0,03		s.CaO (f.CaO)	%		
Çözünmeyen Kalıntı (Insoluble Residue)							
Katkı Miktarı (Additive Amount)			MEKANİK TESTLER (MECHANICAL TESTS)	GÜN (DAY)		AKTİVİTE, % (ACTIVITY)	
(CaO + MgO) / SiO <sub>2</sub>	min. 1,00	1,02		1			
CaO + MgO + SiO <sub>2</sub>	min. 66,67	82,00		2			
Camsı Faz (Glass Content)		100,00		7		min. 45,0	51,6
Rutubet (Moisture)	max. 1,00	0,05		28		min. 70,0	
				GÜN (DAY)		EĞİLME DAYANIMI, MPa (FLEXURAL STRENGTH)	
				28			

# Experimental Notes : Heat Curing or Room Temperature ?



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A 3D rendered city street scene featuring several multi-story buildings with a light green color scheme. The buildings have various roof designs, including flat roofs with small rectangular protrusions and gabled roofs. The street is paved with light gray bricks and has a white car parked on the right side. There are stylized trees and a street lamp on the left side. The overall scene is brightly lit, suggesting a sunny day.

Thank you