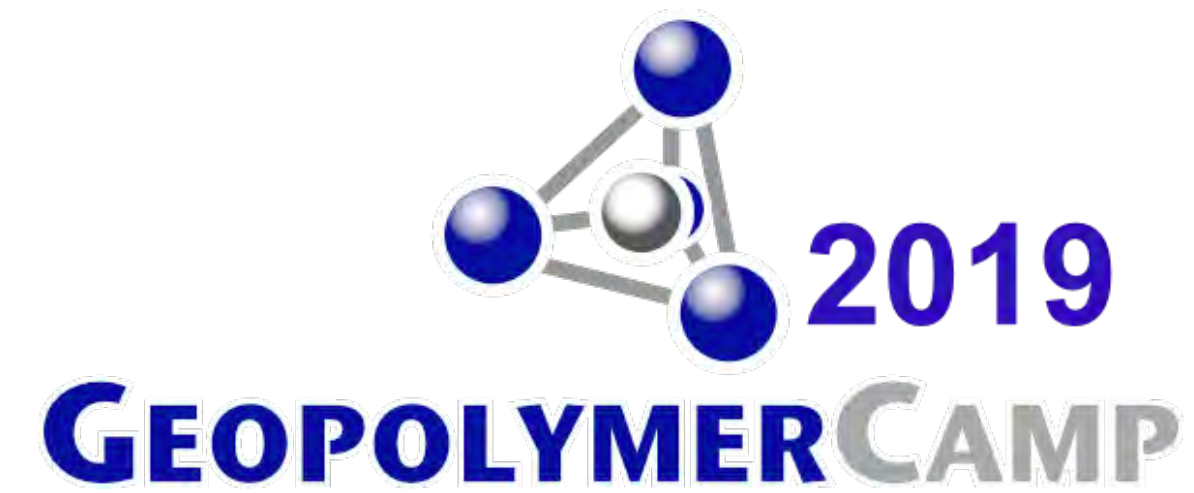




## Creating the Geopolymer Standards

- 1) Testing of metakaolins for GP-reactivity.
- 2) Testing acid resistance of geopolymer samples.

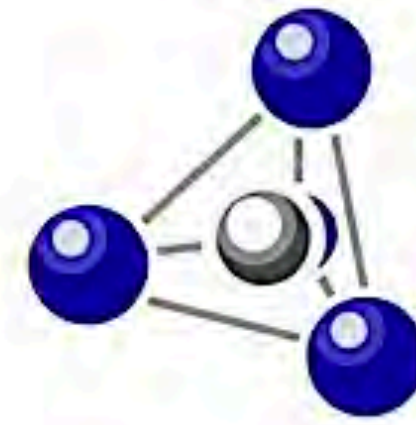
*Joseph Davidovits*



# Creating the Geopolymer Standards

1) Testing of metakaolins for GP-reactivity.

*Joseph Davidovits*



Technical Paper #26-MK-testing

May, 2019

<https://www.geopolymer.org/category/library/technical-papers/>

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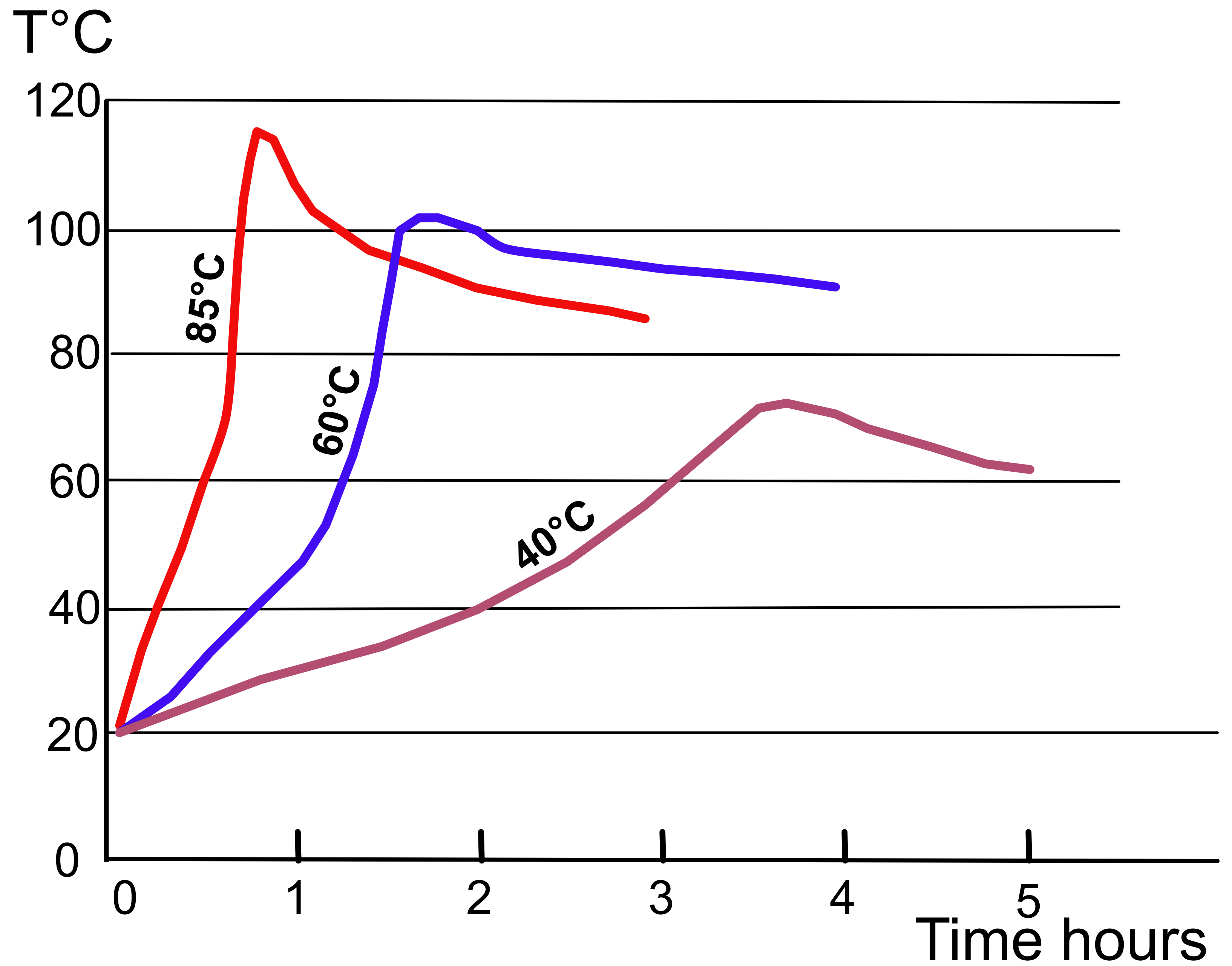
## **Standardized Method in Testing Commercial Metakaolins for Geopolymer Formulations.**

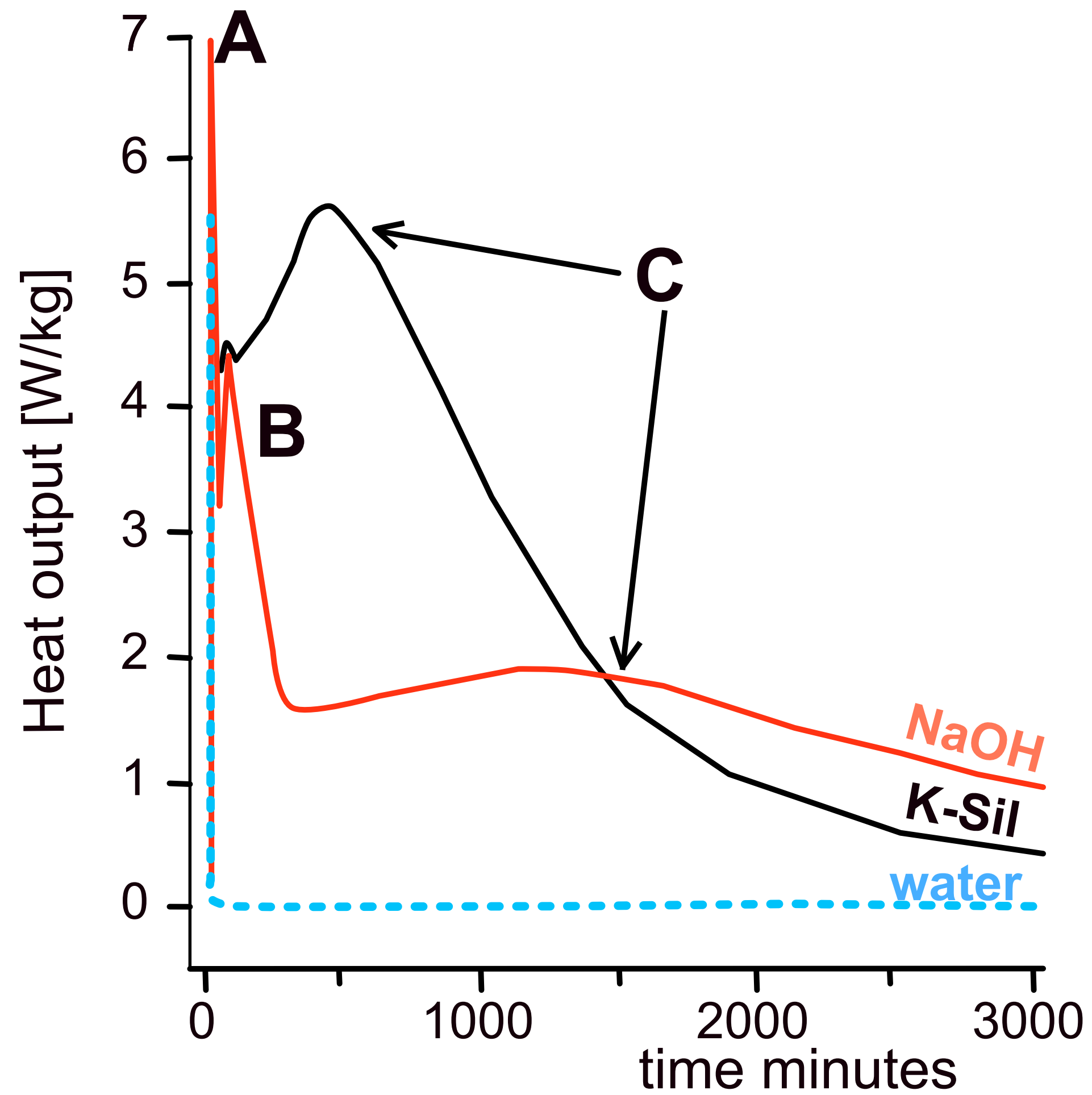
Ralph Davidovits <sup>a,b</sup>, Christine Pelegris <sup>a</sup> and Joseph Davidovits <sup>b\*</sup>

<sup>a</sup> Matériaux Avancés en Géopolymère, LTI - Université de Picardie Jules Verne,  
02100 Saint-Quentin, France.

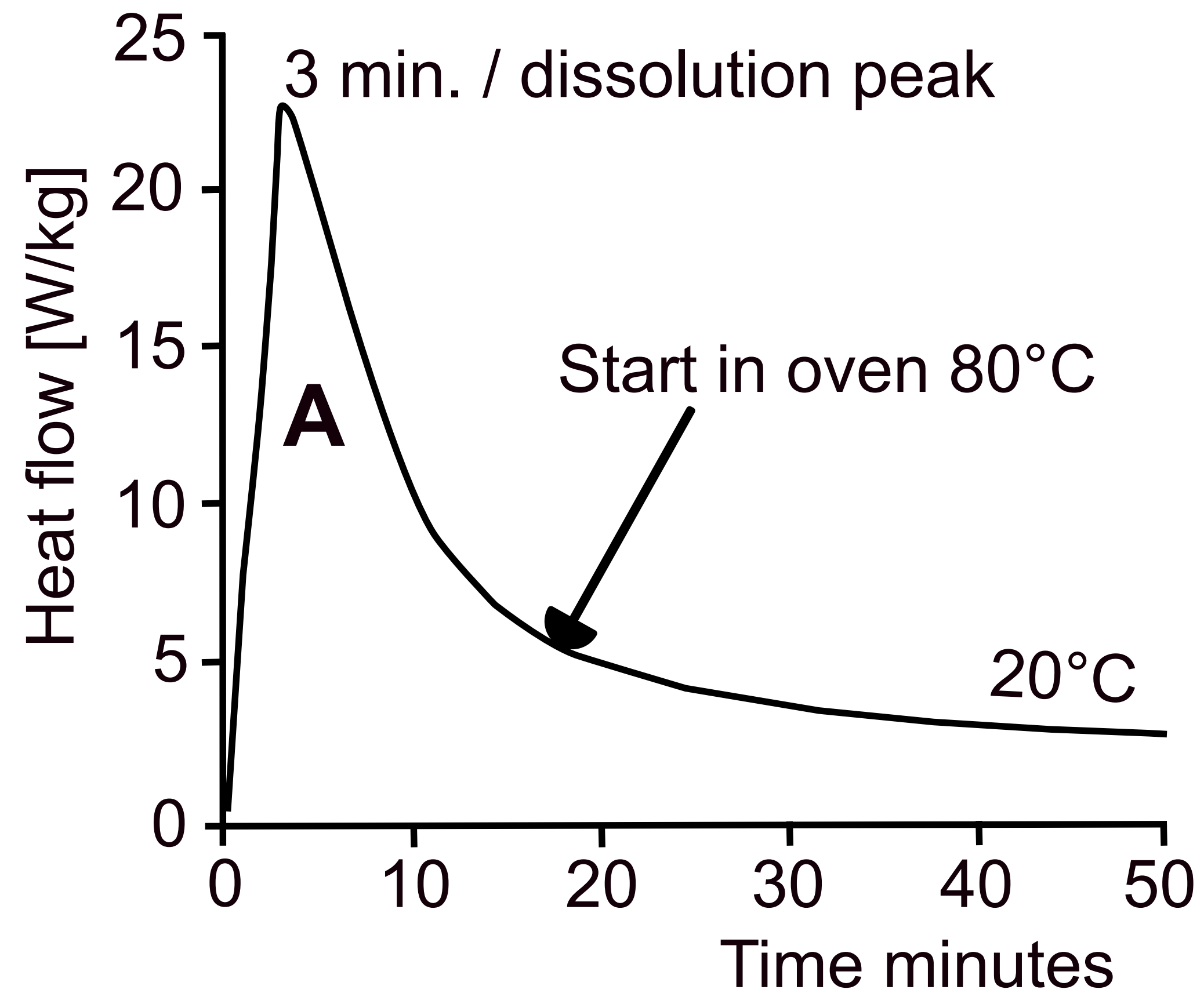
<sup>b</sup> Geopolymer Institute, 02100 Saint-Quentin, France.

Exothermic  
polycondensation of  
MK-750-based  
geopolymer binder K-PSS  
at different curing  
temperatures





*Heat flow isothermal calorimetry at 20°C, DSC with the systems NaOH/MK, K-Sil/MK and water/MK.*



*Exothermal peak (A) for NaOH/MK at 20°C, heat flow with time*

# Reactivity test, observing exothermicity

see: *J. Davidovits, Geopolymer Chemistry and Applications, Chapter 8.*

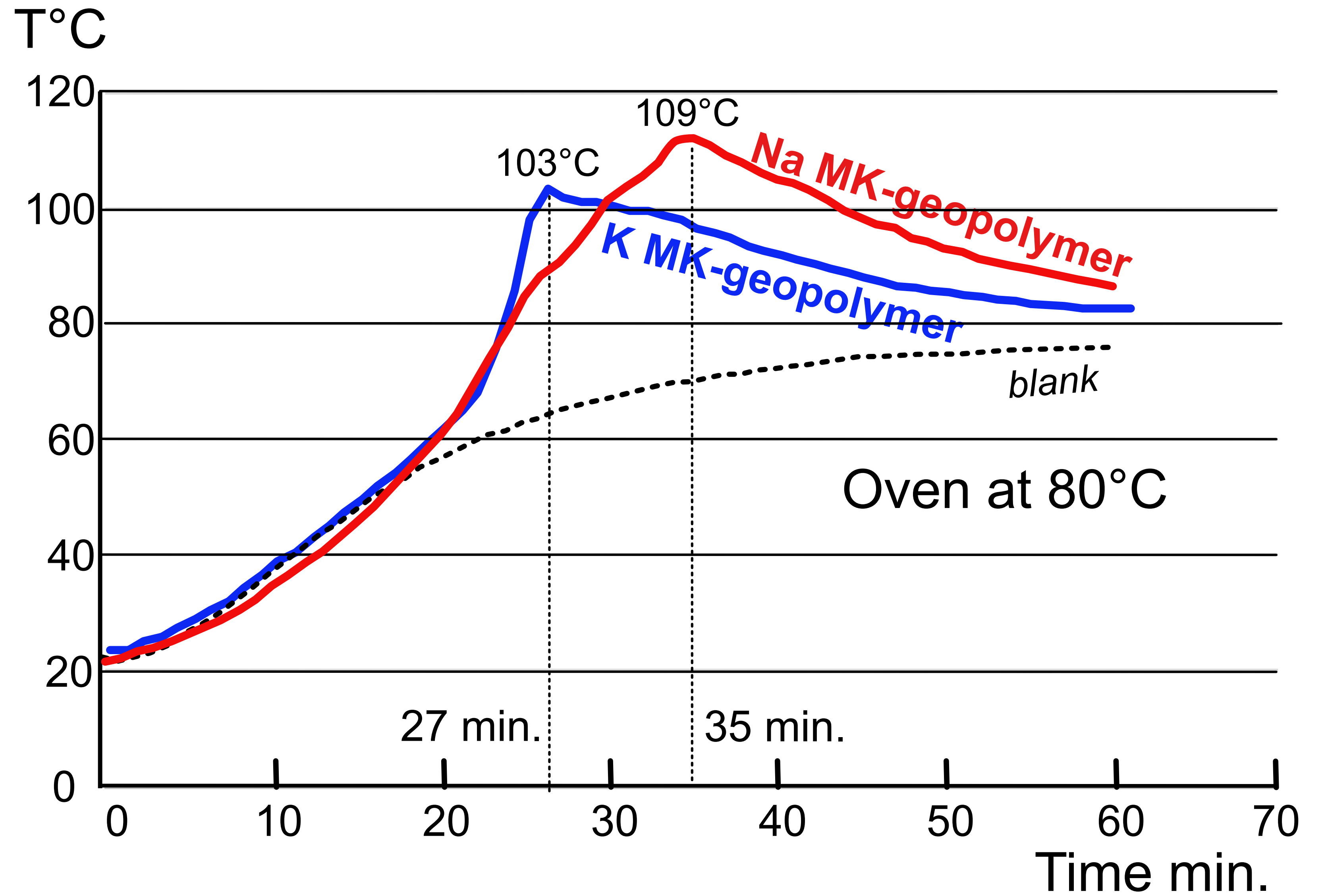


# Reactivity test, observing exothermicity

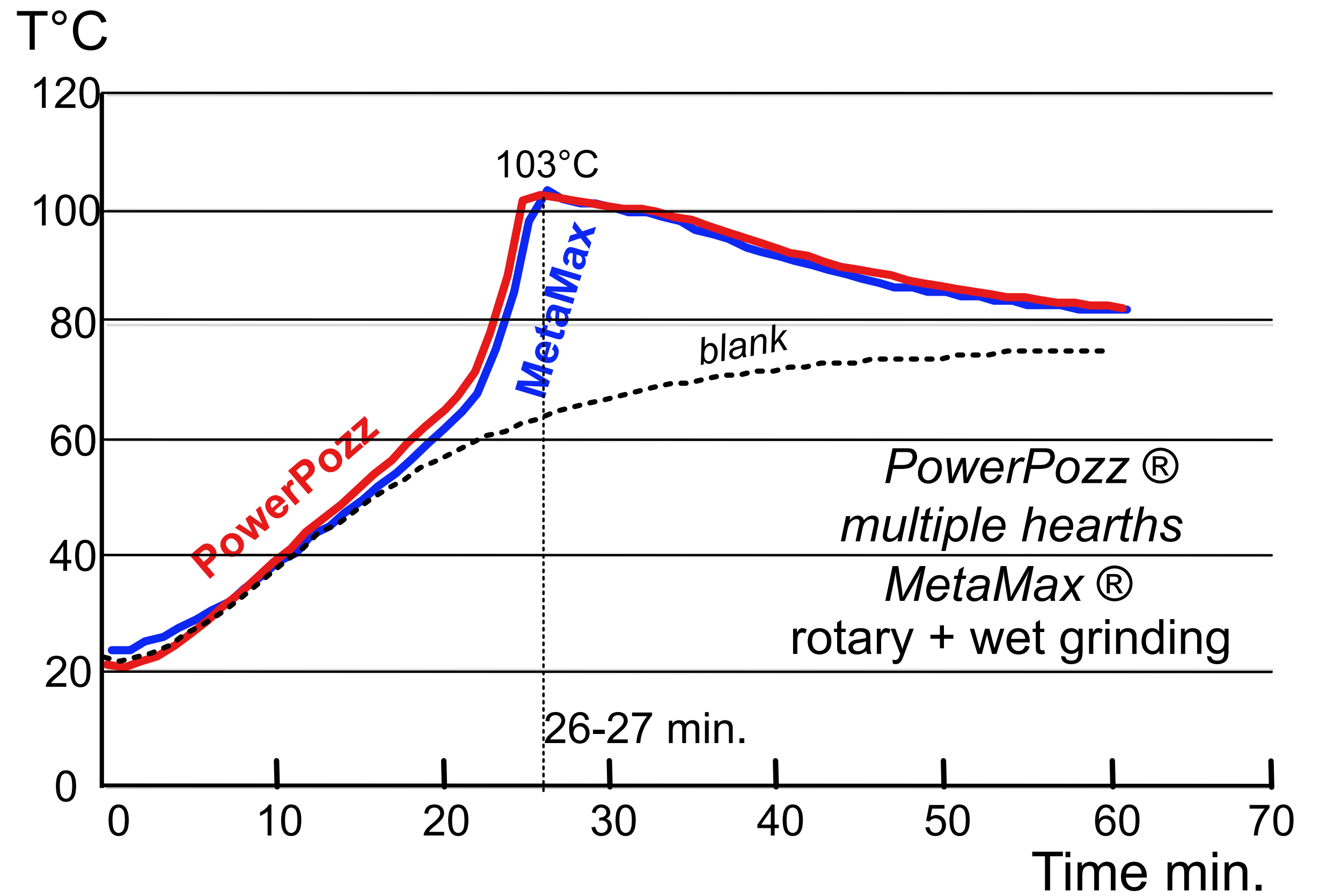
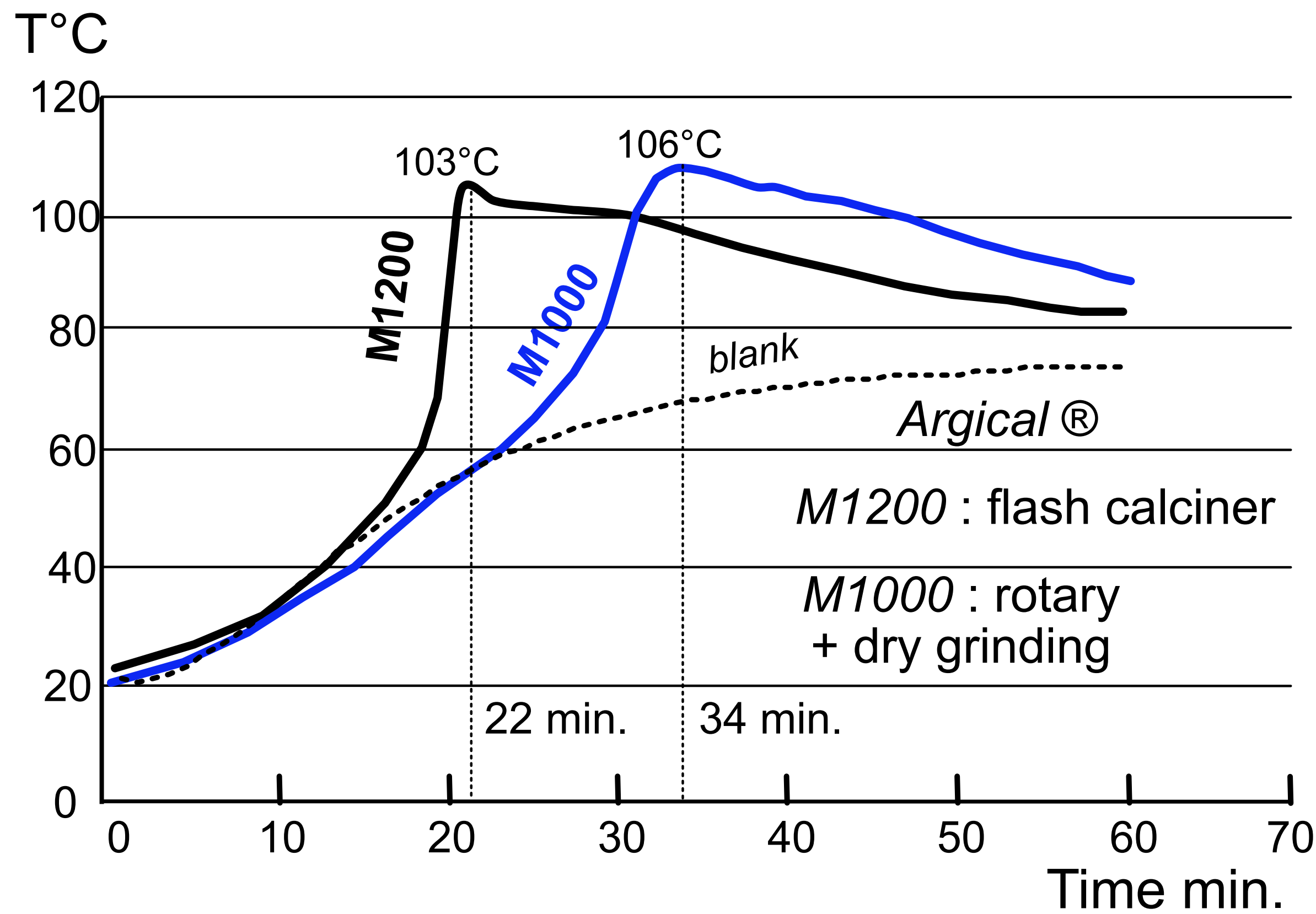


Sample: 100 g of K-silicate  $MR=1.7$ , 60 g of metakaolin,  
10 min. mixing, 1 hour at  $80^{\circ}\text{C}$   
Blank: 55 g of water, 60 g of metakaolin

K silicate and Na  
silicate solutions,  
MR=1.7  
(MK *MetaMax*)

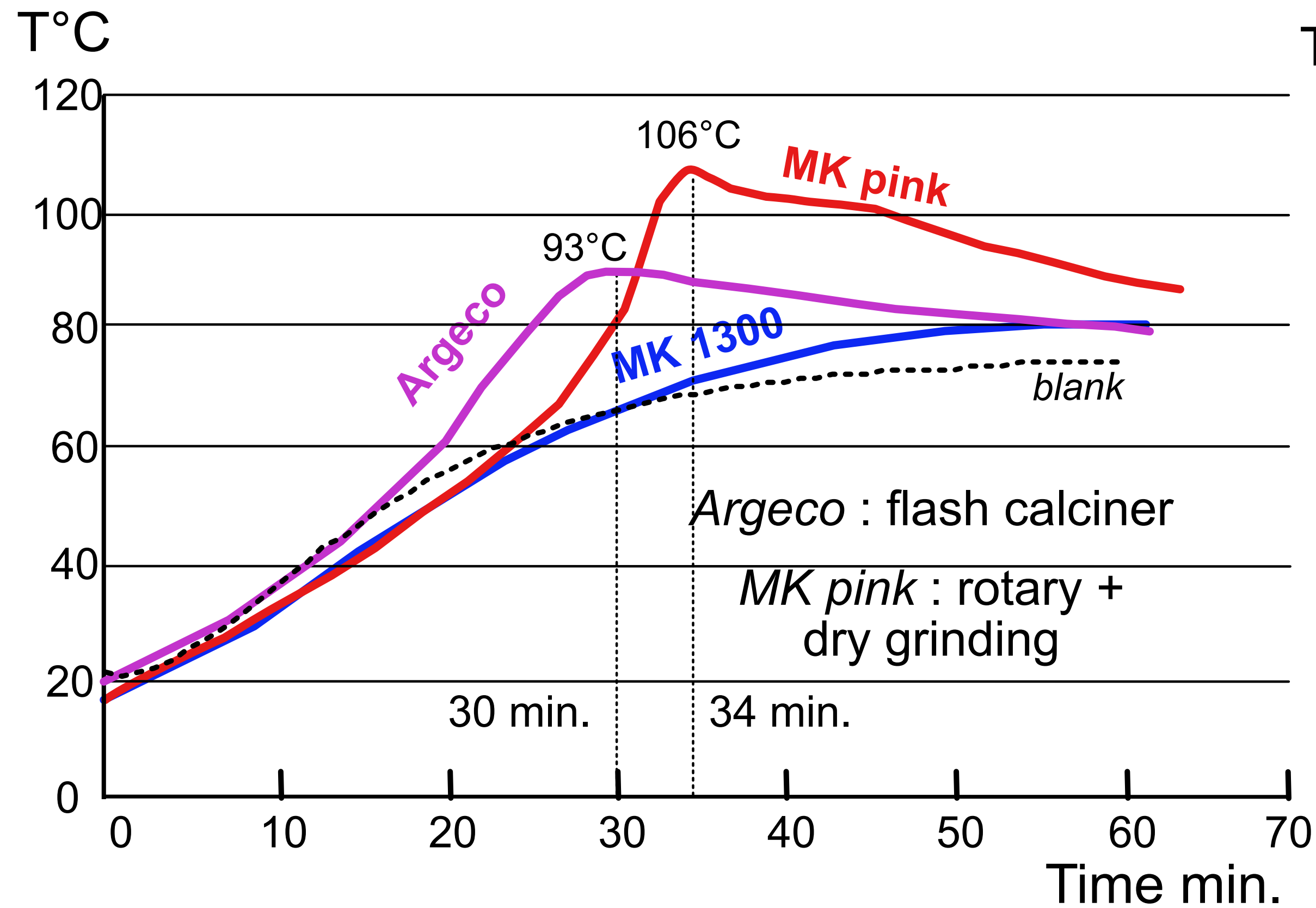




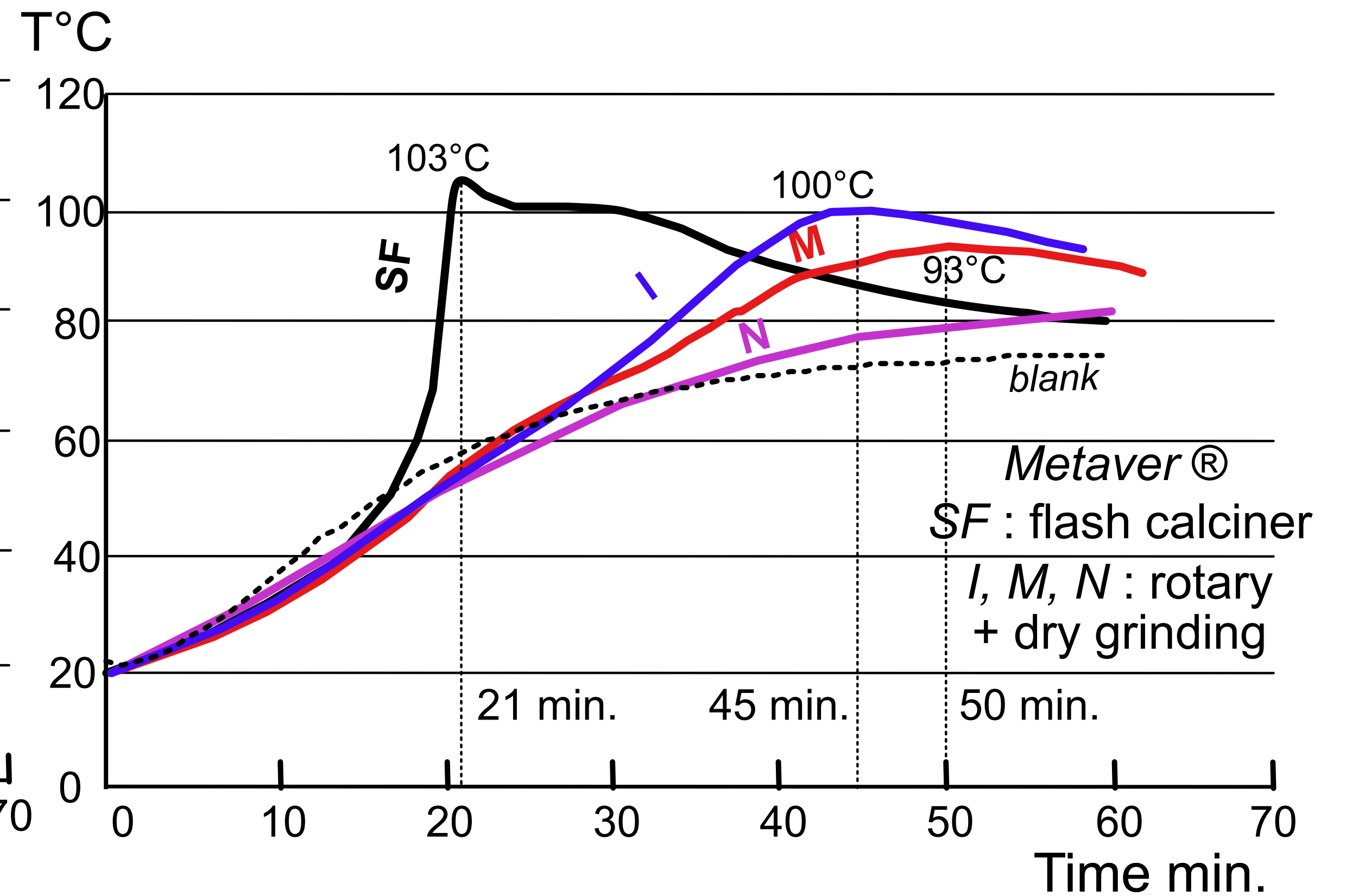


*Argical M1200, M1000*, same geological sources (Clerac, France) and different calcining methods: flash and rotary.

*PowerPozz, MetaMax*, same geological sources (Georgia, USA), and different processing methods (multiple hearths and wet grinding).



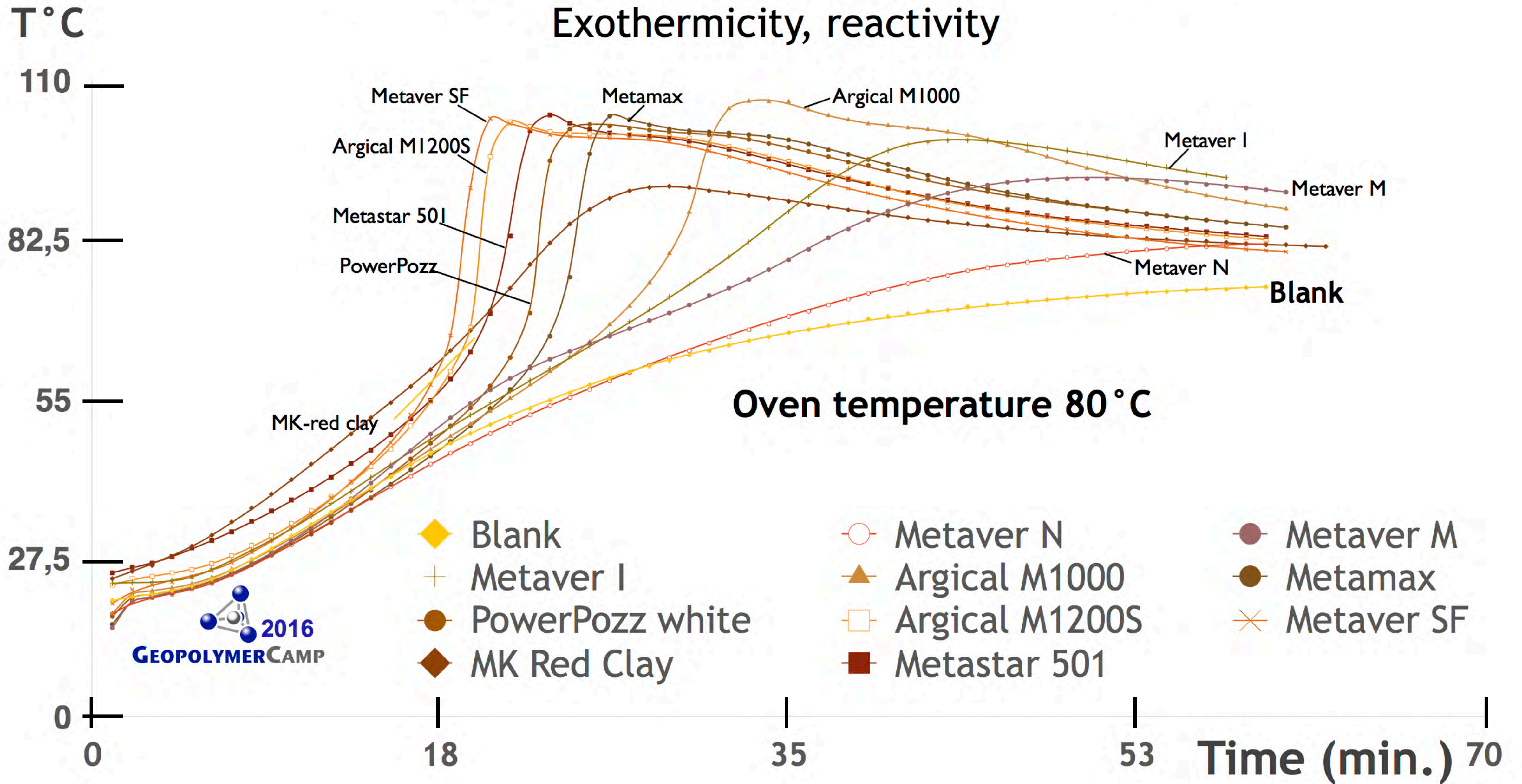
*MK pink, MK 1300, MK Argeco,*  
 different geological sources and  
 different calcining methods: flash  
 and rotary.



*Metaver SF, I, M, N: same supplier,*  
 different geological sources and  
 calcining methods.

# Testing of 10 commercial metakaolins

## Exothermicity, reactivity



## Exothermic data for eleven commercial MKs:

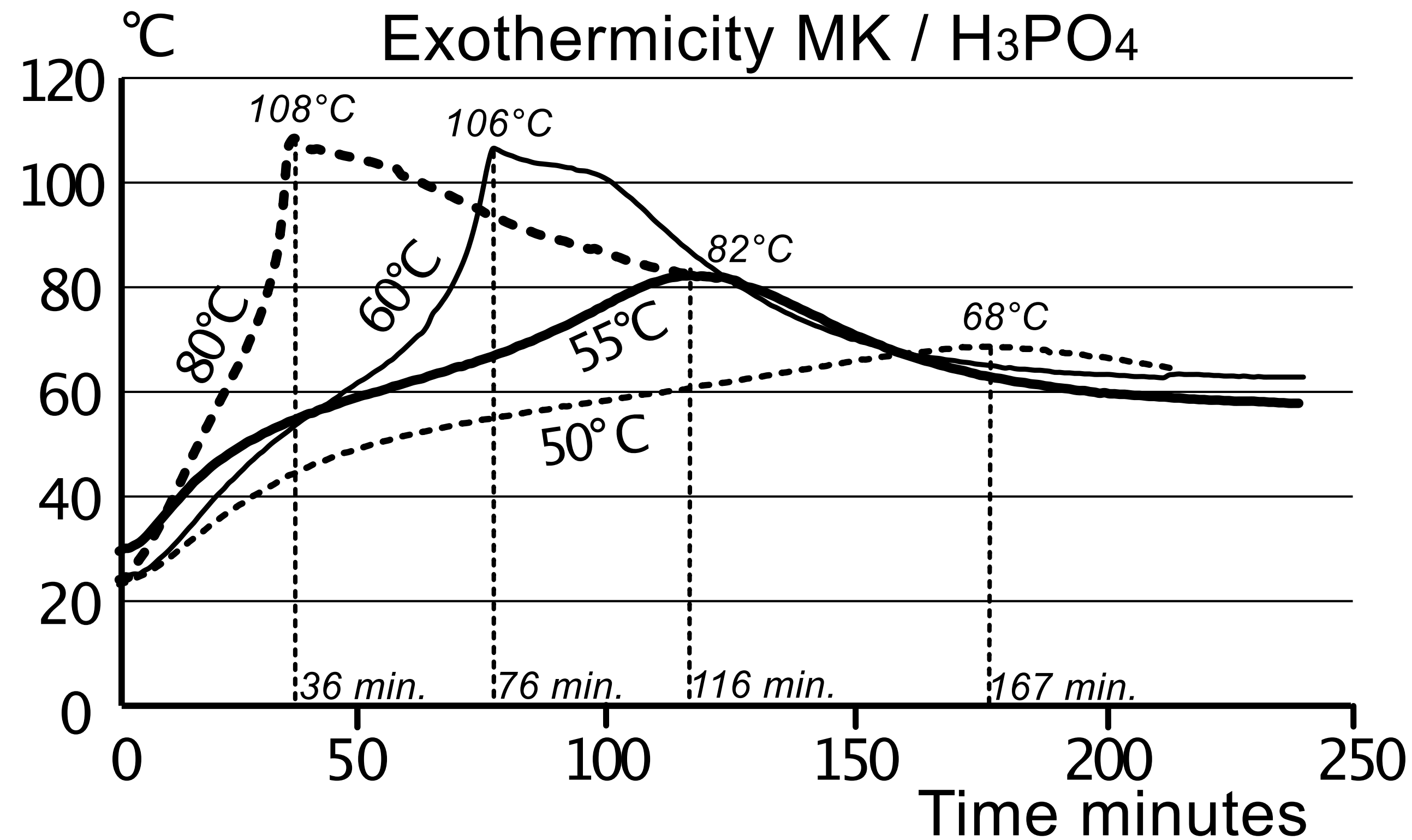
- time in minutes at exothermic maximum,
- temperature at maximum measured during curing at 80°C,
- calcination method.
- pozzolanic activity (data from suppliers) .

	Time min. exo max	T°C max	Pozzolanic activity*	Calcination method
Metaver SF	21	103	1280*	Flash
Argical M1200	22	103	1370*	Flash
Powerpozz	26	103	rapid	Herreshoff
MetaMax	27	103	-	Rotary +
MK Argeco	30	93	-	Flash
Argical M1000	34	106	1150*	Rotary
MK Pink	34	106	-	Rotary
Metaver I	45	100	rapid	Rotary
Metaver M	50	93	very rapid	Rotary
Metaver N	>60	82	rapid	Rotary
MK 1300	>60	80	-	Rotary

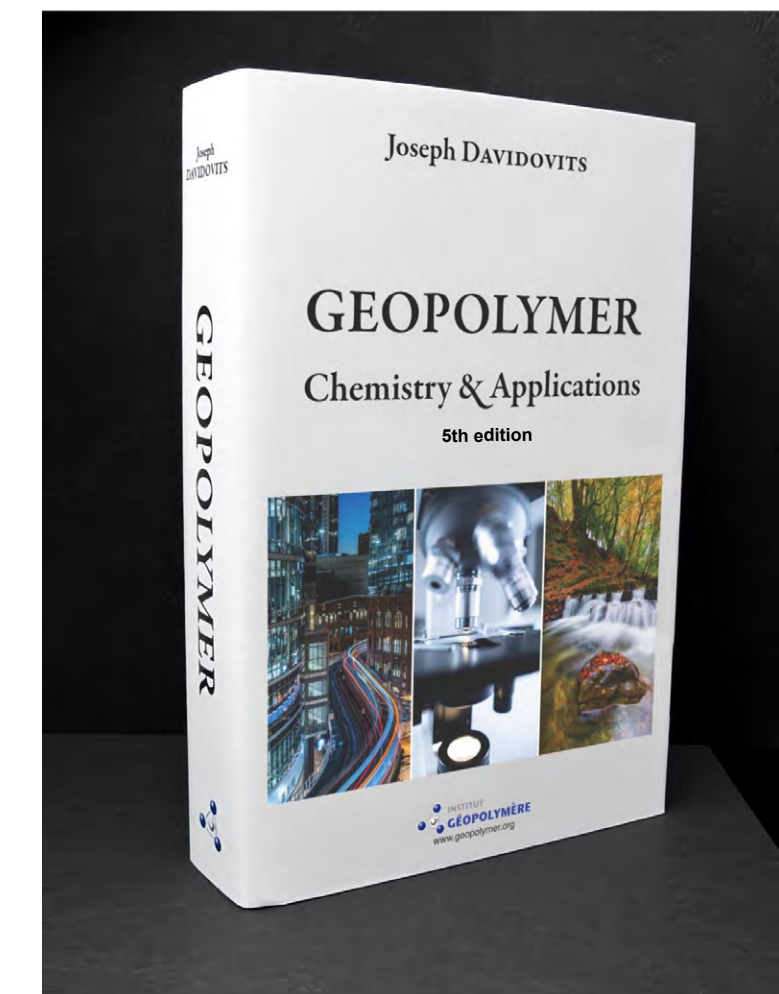
\* Chappelle test.

# 16 research topics

## #8 Phosphate-based geopolymer



Ralph Davidovits et al. (2019)





# Creating the Geopolymer Standards

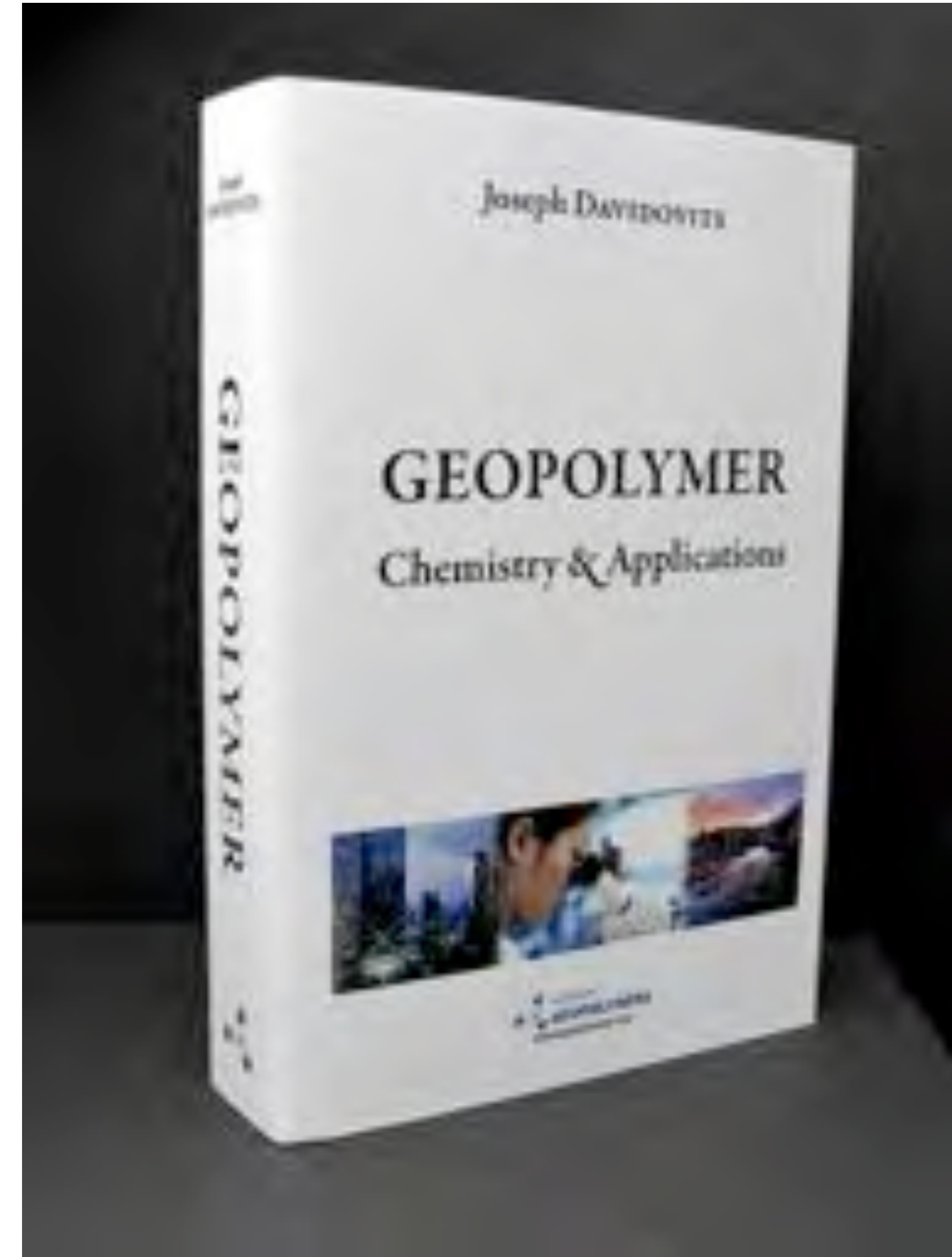
2) Testing acid resistance of geopolymer samples.

*Joseph Davidovits*

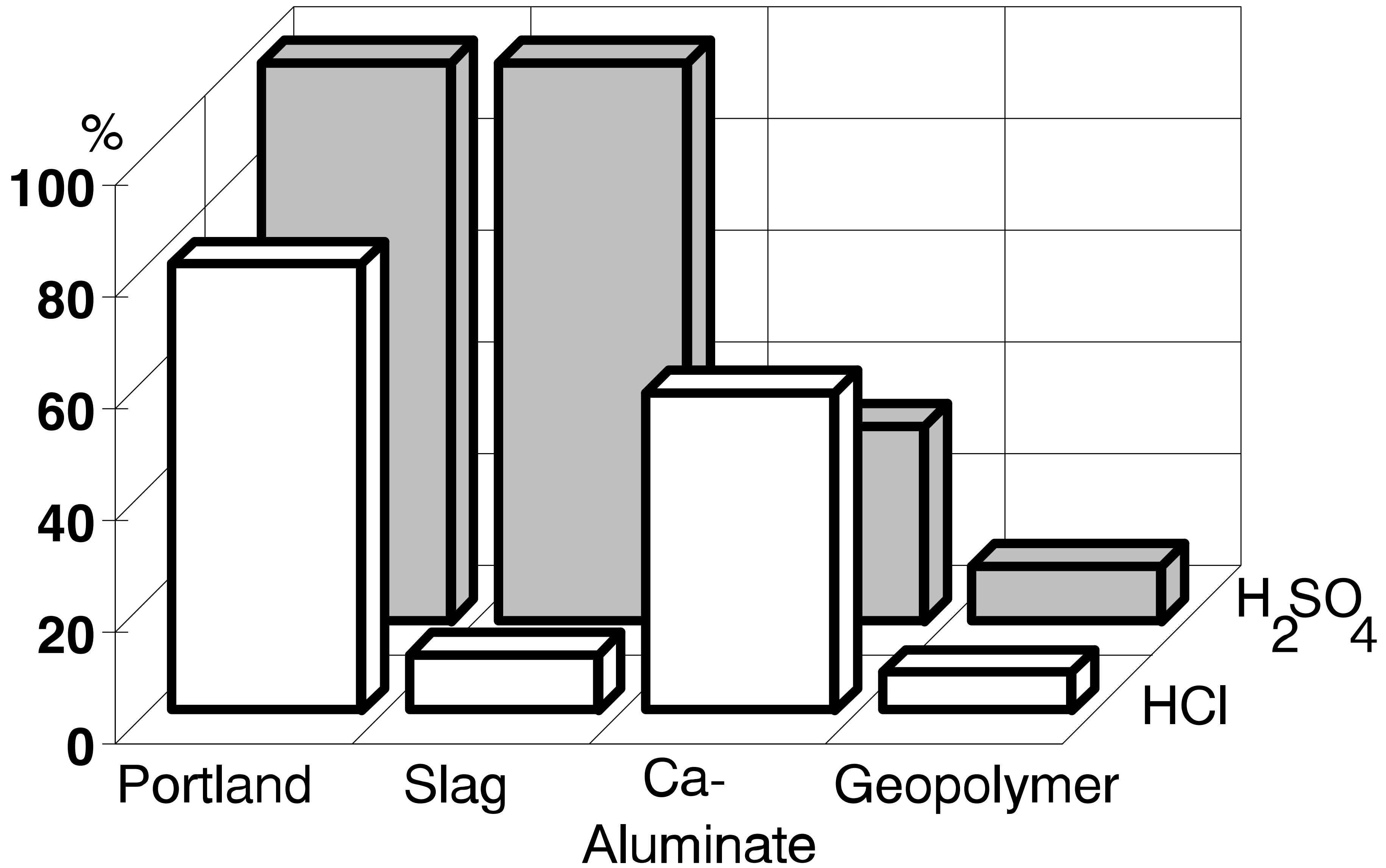
# Standard on geopolymer resistance to acids

With respect to acid resistance and the associated leaching testing, we have been faced with a dilemma due to the absence of an appropriate standard procedure.

We decided to fix the conditions of acidic attack to 5 % acid weight concentration, and room temperature.



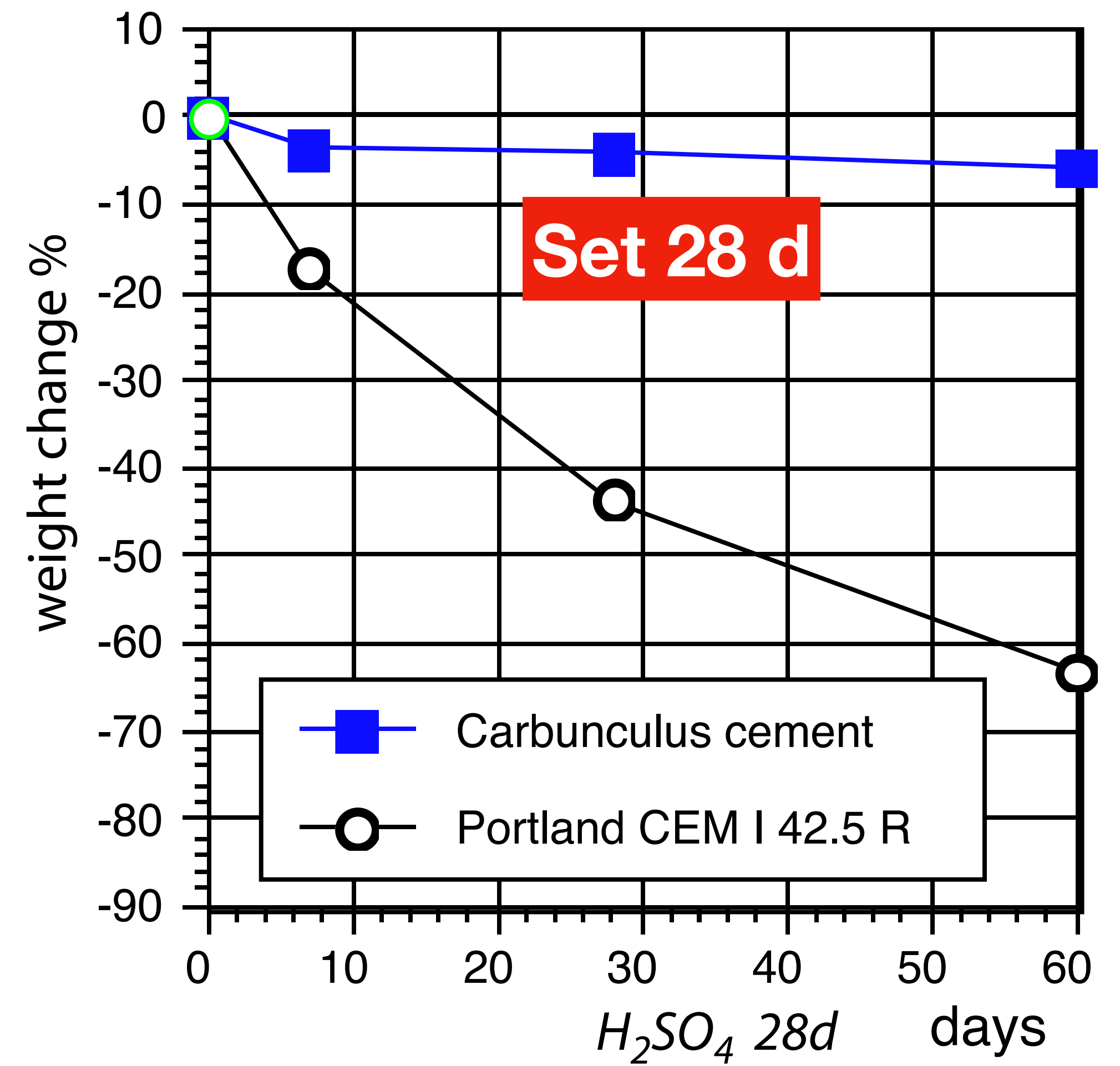
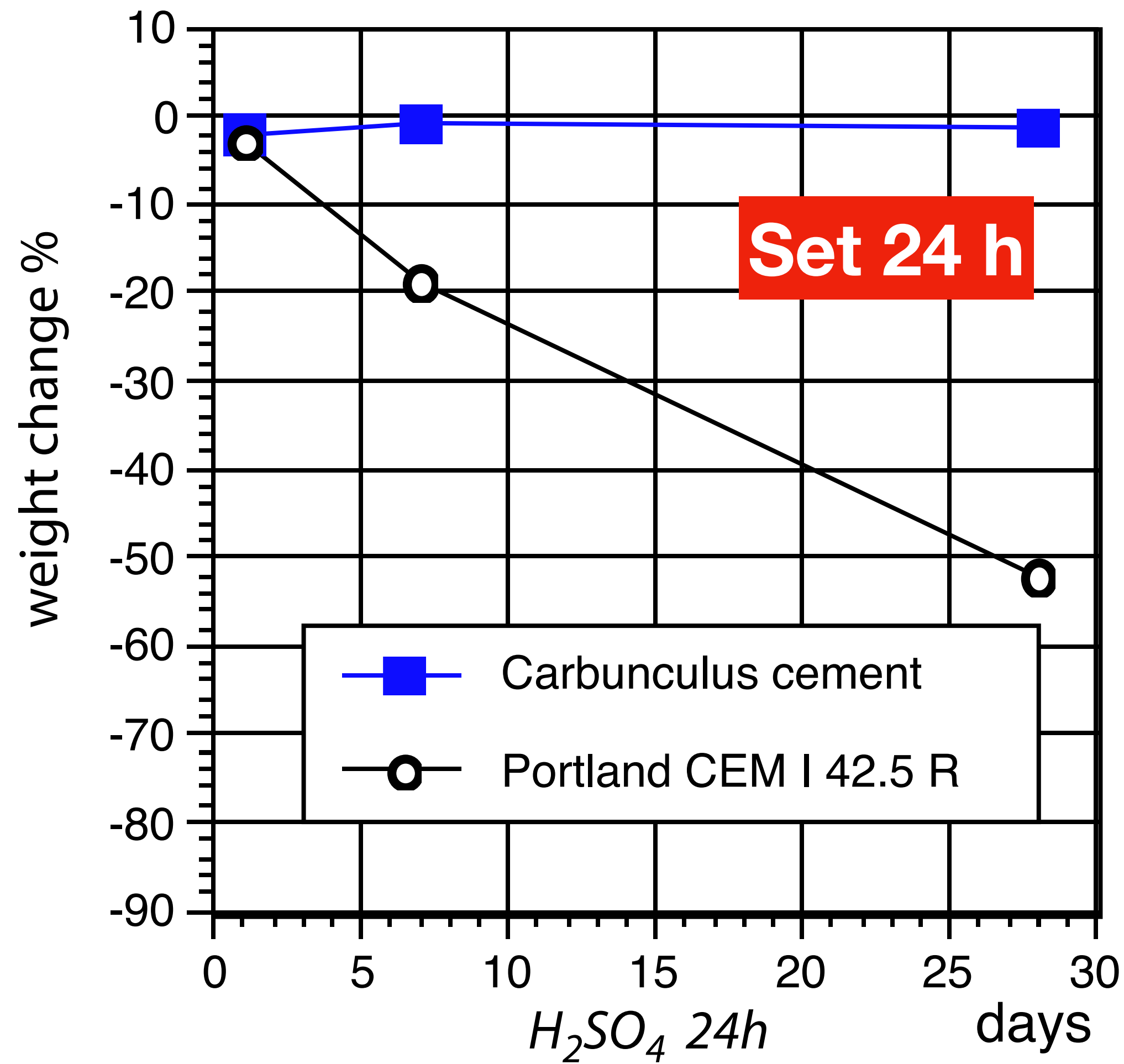
**Chapter 17**



Break up, weight %, in 5 % acid solution (Davidovits, 1993).



# MK / Slag-based geopolymer cement vs. Portland cement



Sulfuric acid solution (5 %).

# Other standard projects

Fire resistance and Heat resistance

Geopolymerization / hardening:  
Boiling water  
wet / dry

