

## Sintering of Al<sub>2</sub>O<sub>3</sub> with control of the shrinking rate

### INTRODUCTION

Because during sintering the dimension of the ceramic material changes drastically, it is important to control this variation to have a final product with the required dimensions and properties. TMA provides information about volume shrinkage, powder grain growth, and their interactions. The THEMYS TMA enables the control of the sintering rate during the experiment, thus providing valuable information about the temperature profile to be applied to the industrial sintering furnace.

### EXPERIMENT

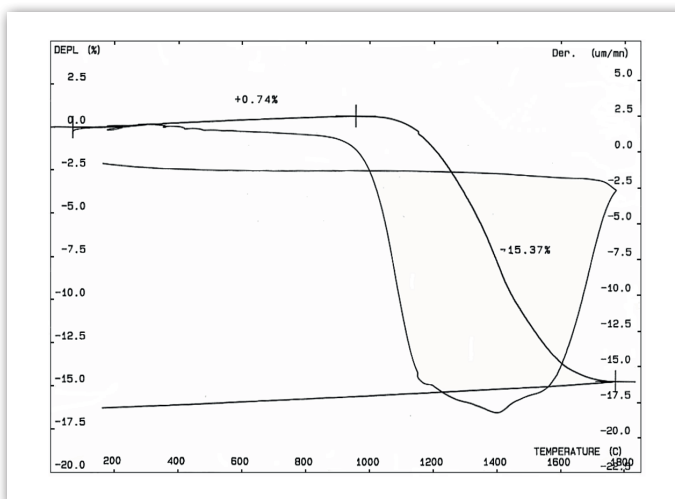
A cylindrical sample of alumina (Diameter = 10 mm, height = 20 mm) is heated with a heating rate of 5 K/min up to 1780°C.

Alumina probe.

Carrier gas : helium.

Maximum shrinking rate = 20 µm/min.

Use of software package to control the shrinking rate.



### RESULTS AND CONCLUSION

When the sample of alumina is heated at 5 K/min continuously a shrinkage due to the sintering of about 15 % is observed. The maximum of shrinking rate is about 60 µm/min it means that the heating rate (in K/min) will be reduced in order to have a shrinking rate <20 µm/min.

The main interest of the method is to be able to determine in one run the temperature program for sintering at constant shrinking rate.

### INSTRUMENT

#### THEMYS TMA



- PRESERVATION OF SAMPLES**  
due to low load vertical TMA system.
- ULTRA-HIGH TEMPERATURE CAPABILITY**  
to 2400°C with a single furnace.
- MODULAR ADAPTIONS ALLOWING**  
TGA only, DTA only, TG-DTA, and TMA up to 2400°C, DSC only and TG-DSC up to 1600°C all in one instrument.
- EXTERNAL COUPLING CAPABILITY**  
designed for evolved gas analyzers (FTIR, MS, GCMS, MSFTIR, or FTIR-GCMS)