

## Gypsum (Calcium Sulfate Dihydrate)

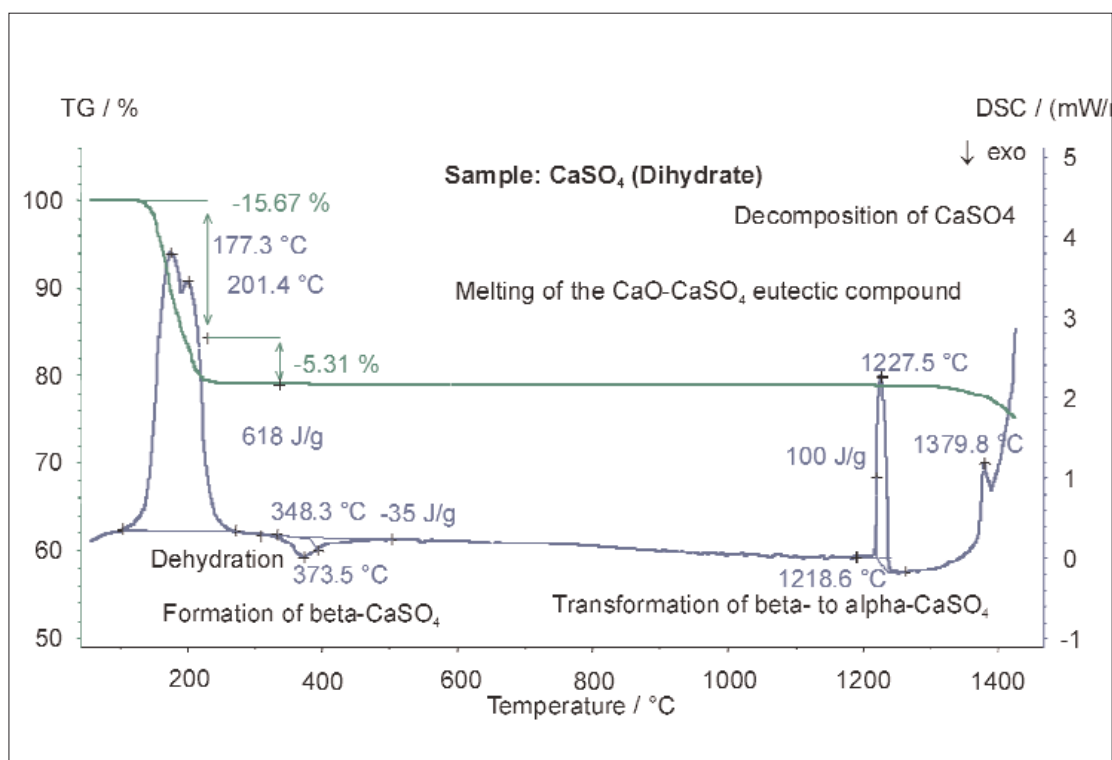
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Calcium sulfate materials (gypsum) are popular materials used in several building applications. When calcium sulfate half-hydrate is mixed with water, it re-forms into gypsum (dihydrate), initially as a paste but eventually hardening into a solid. The structure consists of sheets of  $\text{Ca}^{2+}$  and  $\text{SO}_4^{2-}$  ions held together by hydrogen bonds of the water molecules. The grip between these sheets can easily be broken, so gypsum is fairly soft. Gypsum is used as a building material similar to mortar or cement. Like those materials plaster starts as a dry powder that is mixed with water to form a paste which then hardens. Unlike those materials, plaster remains quite soft after drying, and can easily be manipulated with metal tools or even sandpaper. These characteristics make plaster suitable for a finishing rather than a load-bearing material.

## Test Conditions:

**Temperature range:** RT ... 1500°C  
**Heating/cooling rates:** 20 K/min  
**Atmosphere:** Air at 60 ml/min

**Sample mass:** 38.68 mg  
**Crucible:** Pt with lid  
**Sensor:** DSC type S



## Results:

Between 100 and 300°C, the double-step dehydration of the calcium sulfate-dihydrate occurred. In the first step, 1.5 out of 2 water molecules were released from the system and half-hydrate was formed. In the second, the half-hydrate dehydrates further on and forms anhydrite. Starting at 348°C, the anhydrite converts to  $\beta$ -calcium sulfate (exothermic effect). At 1219°C the  $\beta$ -calcium sulfate converts to  $\alpha$ -calcium sulfate, clearly visible as a sharp exothermic effect in the DSC curve. At temperatures above 1250°C, a further mass loss can be seen. This mass loss refers to the sulfate decomposition. Calcium sulfate converts into calcium oxide. The endothermic peak at 1380°C is due to melting of an eutectic mixture of calcium sulfate and calcium oxide.