

TUNNELWORKS

AS CHEMISTRY

STUDENT SHEET

What's the enthalpy change when cement hydrates?

Concrete uses cement as the 'glue' that binds sand and aggregates together. Cement is a mixture of compounds, typically:

Tricalcium silicate	50%
Dicalcium silicate	25%
Tricalcium aluminate	10%
Tetracalcium aluminoferrite	10%
Gypsum	5% (controls the rate of reaction)

The tricalcium and dicalcium silicates make up the bulk of the cement and provide its long-term strength as they hydrate over time.

Calculate the change in enthalpy during the hydration of tricalcium and dicalcium silicates.

Experimental method

A measured mass of each compound was added to sufficient water in a beaker placed in an insulated water bath. The water bath contains 1200g water. A temperature probe linked to a data logger measured the maximum temperature rise over time. This was repeated four times for each compound.

Experimental data

For 344g Ca ₂ SiO ₄		
Run	Starting temp °C	Final temp °C
1	25.1	36.9
2	24.9	36.5
3	25.0	36.8
4	24.8	36.4

For 456g Ca ₃ SiO ₅		
Run	Starting temp °C	Final temp °C
1	25.1	36.9
2	24.9	36.5
3	25.0	36.8
4	24.8	36.4

Background data

c for H₂O = 4181 Jkg⁻¹

Atomic masses: Ca = 40, Si = 28, O = 16

