CP determination of product
A + B → C

Experimental

Theory:

During a calibration, the response of the DRC is given by the equation :

$$\Delta T = \Delta T_0 + P \times S \left(1 - e^{-\frac{t}{\tau}}\right)$$

with $\tau = (m \times CP + CPi) \times S$

and

$\Delta T0$ /°C : response of DRC before calibration

P / W : power dissipated during the calibration

S /°C.W $^{-1}$: sensitivity of DRC

t / s : time

τ / s : response time of DRC

m / g : mass of reagent

CP / J.g^{-1}.K^{-1} : specific heat capacity of reagent

CPi / J.g^{-1}.K^{-1} : heat capacity of inserts (probes, stirrer,..)

It gives : $$C_P = \frac{\frac{\tau}{S} - C_{Pi}}{m} \quad (1)$$

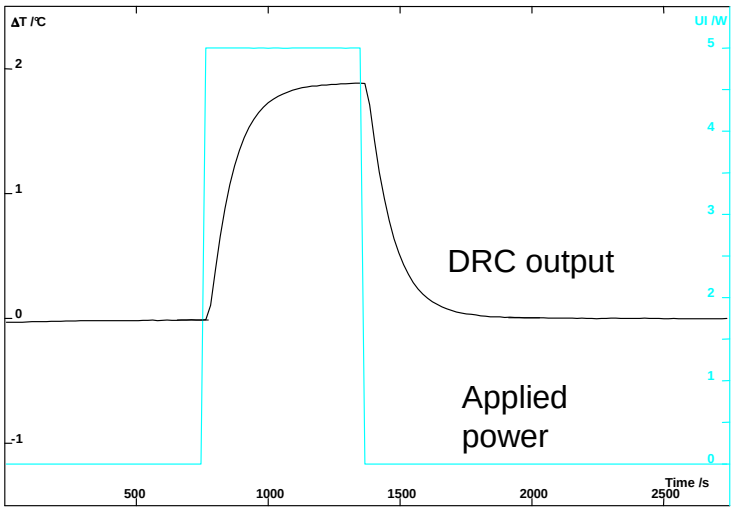

Figure 1 : Joule effect

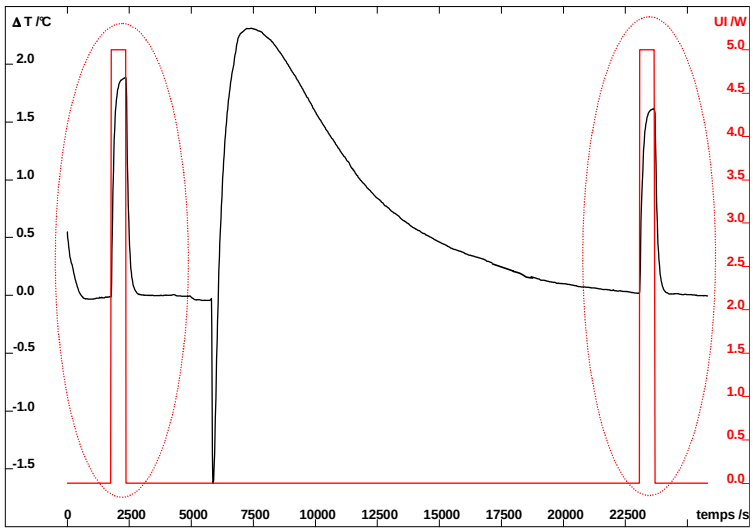

Figure 2 : Joule effect before and after reaction

Practical determination :

A Joule effect is produced on applying a constant power of 5 Watts during 900 s. In fact we apply a Joule effect before and after the reaction (Figure 2). The output of DRC is monitored versus time (Figure 1). The DRC crenel is integrated and the value of response time τ automatically determined.

For the first calibration, we use the formula (1) where S, the mass m_{rA} of reagent and the C_P of reagent C_{PrA} are known. C_{Pi} (C_P of inserts) is thus calculated.

For the second calibration, the formula (1) is used again but this time C_{Pi} is known (it was calculated in the first calibration) and C_{Pc} (C_P of product) calculated.

In the example C_{Pc}= 2.11 J.g^{-1}.K^{-1}

Instrument :

DRC (- 80, + 150°C)