

## Kinetics of Mu addition to acetone in superheated water

J.-C. Brodovitch, B.M. McCollum and P.W. Percival

*Department of Chemistry and TRIUMF, Simon Fraser University 8888 University Drive,  
Burnaby, British Columbia, Canada V5A 1S6*

The rate constant for the addition of muonium to acetone in aqueous medium has been measured in sub- and supercritical conditions at 250 bar in the temperature range 100 C – 400 C. Up to  $\approx 200$  C, the reaction shows the expected Arrhenius behaviour. However above  $\approx 250$  C, the rate constant goes through a maximum then drops by a factor of 3 between 300 C and 400 C, the maximum temperature studied (Fig. 1). Acetone exists as the keto and the enol form in an equilibrium which has been shown to shift towards the enol form in superheated conditions [1]. If one allows muonium to react with both forms, each with a different rate constant, one can account qualitatively for the initial drop of the measured rate constant. However, using physically meaningful kinetic parameters this simple model fails to reproduce the observed drop in the rate constant above 300 C, suggesting that other mechanisms are involved in this temperature/pressure regime. This confirms similar observations made for muonium reacting with very different substrates [2,3], indicating that the decrease of the value of the rate constant with increasing temperature above supercritical conditions is a general phenomenon in aqueous solution.

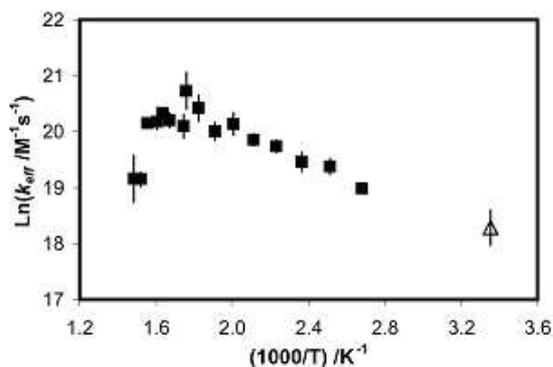


Fig. 1: Temperature variation of the rate constant for the reaction Mu + acetone in aqueous solution at 250 bar. The open triangle shows the value at 25 C (1 atm).

- [1] K. Ghandi, B. Addison-Jones, J.-C. Brodovitch, B.M. McCollum, I. McKenzie and P.W. Percival, *J. Am. Chem. Soc.* 125 (2003) 9594.  
 [2] K. Ghandi, B. Addison-Jones, J.-C. Brodovitch, S. Kecman, I. McKenzie and P.W. Percival, *Physica B* 326 (2003) 55.  
 [3] P.W. Percival, J.-C. Brodovitch, K. Ghandi, B.M. McCollum and I. McKenzie, *Radiation Physics and Chemistry* 76 (2007) 1231.