# Viscosity Measurements of Selected Ionic Liquids Using a Vibrating Wire Technique

Fernando Caetano
*Universidade Aberta, Lisbon, Portugal*

José Correia da Mata
*Academia Militar, Lisbon, Portugal*

João M.N.A. Fareleira [C, S]
*Instituto Superior Técnico, Universidade Técnica de Lisboa, Lisbon, Portugal*

William A. Wakeham
*University of Southampton, Southampton, United Kingdom*

The main characteristics of low temperature ionic liquids, in particular the possibility to design the structure of their ions in a manner suitable for particular applications, making available, tailor-made or fit-for-purpose substances, have generated enthusiastic attention among the scientific community. One of the most important bulk properties from the viewpoint of industrial applications is the viscosity. Therefore there have been a significant number of measurements of the viscosity of ionic liquids in recent years. However, the most popular techniques for this purpose, such as capillary methods, present some particular difficulties for ionic liquids. For example their surface tension, is usually (K. N. Marsh, J. A. Boxall, R. Lichtenthaler, Fluid Phase Equilib. 2004, 219, 93-98) significantly different from either that of water as well as other standard reference liquids commonly used to calibrate capillary instruments, which can cause important measurement uncertainties (F. J. P. Caetano, J. M. N. A. Fareleira, A. Fernandes, C. M. B. P. Oliveira, A. P. Serro, I. M. Simões de Almeida, W A Wakeham, Fluid Phase Equilib. 2006, 245, 1-5). For that reason we have focused upon a method for measurement that is not dependent on surface tension. In particular, we report the application of the vibrating wire technique in the forced mode of operation to the measurement of the viscosity of low temperature ionic liquids. The results obtained with selected ionic liquids, including 1-ethyl-3-methylpyridinium ethylsulfate, at temperatures within the range $283 < T < 323$ K, under a pressure of 0.1 MPa are presented. Attention will be paid to the characterization of the purity of the samples, with emphasis on their water content, which is known to have a very important effect on the viscosity of ionic liquids in general.