

# Surface Tension Determination Using Electrospray Ionization

Cornelius Louwrens Pieterse<sup>1</sup>, Paul Papka<sup>2</sup>, and Willem Jacobus Perold<sup>1</sup>

<sup>1</sup>Department of Electrical and Electronic Engineering

<sup>2</sup>Department of Physics

University of Stellenbosch, South Africa

e-mail: clpieterse@sun.ac.za

**Abstract**— A new method to determine liquid surface tension using electrospray ionization is described theoretically. This method promises numerous benefits over the current methods of determining surface tension. Unlike most other methods which are restricted to certain liquids, it is possible to use this method with the majority of liquids. One of the unique features of this method is the ability to conduct measurements at arbitrary temperatures, which is generally only limited by the softening point of the borosilicate glass capillaries employed. The method can be utilized to develop a system that requires 5  $\mu\text{L}$  of liquid, compared to most other methods which require a large amount of liquid, varying between 10 and 30 mL. Should it for example be required to do measurements at various temperatures, multiple measurements could be made using one sample. Using a capillary of radius 5  $\mu\text{m}$  and a capillary electrode separation distance of 50  $\mu\text{m}$ , the majority of pure liquid compounds can be studied by applying less than 800 V. The voltage range can be adapted to detect the lower surface tensions, while the maximum tension measurable is determined by corona discharge thresholds. This method has a maximum determination time of approximately 500 ms per sample and a determination resolution in the order of 2  $\mu\text{N/m}$ , when using a voltage resolution of 10 mV. Using the high-end voltage sources currently available, this resolution can be improved to 0.2  $\mu\text{N/m}$  should this be required. Also, other than with conventional methods, a faster operation time does not affect the measurement accuracy. Unlike most methods, the operator does not have to possess vast technical skills to operate the device.