# A Miniature Ion Mobility Spectrometry with a Pulsed Corona-Discharge Ion Source

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We report studies of miniature ion mobility spectrometry (IMS) that employs a pulsed corona discharge ion source. IMS spectra were measured as a function of pulse width and height, drift field, and various corona ionization configurations. Preliminary results indicate that pulsed corona discharge ionization can be used for mm-scale IMS with high sensitivity and good resolution.

A Ni-corona electrode is mounted at the end of a miniature drift tube. A high voltage pulse with a width varying from 400 ns to 400 μs is applied to the electrode relative to the drift potential. During the high-voltage pulse period, ions are generated through field-induced ionization and confined to the vicinity of the tip. After the pulse, the ions move in the drift field. The pulsed corona discharge ionization was found to have lower background, more stable ionization, and simpler operation than a dc corona discharge coupled with an ion gate for ion injection. The corona discharge pulse serves as the ion injection process to start the mobility measurement.

The ratio of corona current (I) divided by corona bias (V), I/V, has been measured as a function of bias (V), and shows a linear relation. This predicts a high stability of sensitivity. However, if the corona electrode is too close to the counter electrode, arcing occurs, which may ultimately limit how small the IMS can be.

Measurement of IMS charge as a function of pulse width shows that the yield of negative ions detected is optimized at a very narrow pulse width and then decreases rapidly as the pulse width increases. These data are interpreted as a competitive process between the formation of negative ions and ion capture by the positively biased electrode. The resolution of the corona discharge IMS was studied with and without an ion injection gate and for various corona dimensions. Under current conditions, a resolution of 10 was achieved. Further optimization of operating parameters is expected to increase the resolving power.

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