

NEGATIVE ION MOBILITY SPECTROMETRY FOR MEASURING ELECTRON ATTACHMENT RATES

Izabela Wolańska¹, Edyta Budzyńska¹, Jarosław Puton¹

¹*Faculty of Advanced Technologies and Chemistry, Military University of Technology, Poland*

E-mail: izabela.wolanska@wat.edu.pl

1. Experimental and Theoretical Study

Ion Mobility Spectrometry (IMS) is an analytical method based on the movement of ions in gases. The sensitivity of the IMS depend on the effectiveness of the substance ionization, which may be increased by changing various measurement parameters, such as a shutter grid opening time, changes in temperature, or the presence of admixtures in gases flowing through the detector. Due to the selective detection of trace amounts of substances and a short time analysis, IMS is used mainly in the detection of chemical warfare agents, toxic substances and explosives materials [1].

Our work is devoted to the study of fundamental phenomena related to the operation of the IMS detector in the negative mode, in which ionization of the sample components occurs through electron capture (EC). This way of ionization is possible when nitrogen is the carrier and drift gas in the detector [2]. The IMS detector can be used not only as analytical tool but also to derive the basic parameter describing the EC - the capture rate constant. In these studies appropriate measurement systems are used for the introduction of samples into the drift section. The results of the experiments are drift time spectra containing characteristic signals. This group of methods, known as SWARM techniques, uses the interaction of swarm of ions or electrons with analyte molecules in gases [3,4].

The main aim of our research was to determine the optimal methods and parameters for conducting the SWARM experiment in the IMS detector. The tests were performed for two exemplary analytes: benzyl and benzal chlorides.

2. References

- [1] G. A. Eiceman, Z. Karpas, H. H. Hill Jr., *Ion Mobility Spectrometry*, CRC Press, Boca Raton, (2014).
- [2] E. Budzyńska et al., *Ion mobility spectrometers and electron capture detector – a comparison of detection capabilities*, *Talanta*, **194** (2019) 159 – 165.
- [3] M. Tabrizchi, A. Abedi, *A novel use of negative Ion mobility spectrometry for measuring electron attachment rates*, *J. Phys. Chem. A* **108** (2004) 6319–6324.
- [4] H. Feng, et al., *Rate constants of electron attachment to chlorobenzenes measured by atmospheric pressure nitrogen corona discharge electron attachment ion mobility spectrometry*, *Int. J. Mass Spectrom.* **305** (2011) 30 – 34