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14. ABSTRACT The nature of this collaboration is to build an accurate ion mobility spectrometry (IMS) instrument with the goal of measuring the reduced mobility (K0) of compounds of interest, such as explosives and volatile standards, to an accuracy of ± 0.002 cm ² V ⁻¹ s ⁻¹ ; an order of magnitude higher than the currently accepted level. A database of the K0's of compounds of interest under various temperatures, pressures, drift gas water content levels, and electric fields will be created and referenced by field deployed instruments in order to improve their own accuracy and reduce their false positive alarm rates. This report details the technical and metric data for fiscal years 2012 and					
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Report Title

Reducing False Alarms in Ion Mobility Spectrometry Detectors Determination of Accurate and Precise Ion Mobility Spectrometry Constants

ABSTRACT

The nature of this collaboration is to build an accurate ion mobility spectrometry (IMS) instrument with the goal of measuring the reduced mobility (K_0) of compounds of interest, such as explosives and volatile standards, to an accuracy of $\pm 0.002 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$; an order of magnitude higher than the currently accepted level. A database of the K_0 's of compounds of interest under various temperatures, pressures, drift gas water content levels, and electric fields will be created and referenced by field deployed instruments in order to improve their own accuracy and reduce their false positive alarm rates. This report details the technical and metric data for fiscal years 2013 and 2014.

**Reducing False Alarms in Ion Mobility Spectrometry
Detectors Determination of Accurate and Precise
Ion Mobility Spectrometry Constants**

**Technical and Metric Data for US Army/ECBC Proposal # 62620-CH
Grant # W911NF-12-1-0575: Fiscal Year 2013 and 2014**

Submitted to:

**Dr. Dawanne Poree
ARO Program Manager and COR
Army Research Office
Research Triangle Park, NC 27709**

Submitted by:

**Dr. Herbert H. Hill
Department of Chemistry
PO BOX 644630
Washington State University
Pullman, WA 99164-4630**

**Tel: (509) 335-5648
Email: hhhill@wsu.edu**

**FY 2013-2014
(October 1, 2012 - September 30, 2014)**

CC:

**Dr. Geoffrey L. Doyle,
Task Manager
LEIDOS**

**Ms. Danielle Anthony
Grant and Contract Coordinator
WSU Office of Grants & Research Development**

A. Army lab/RDEC Collaborations or Tech Transfers

Nature of Collaboration

To build an accurate ion mobility spectrometry (IMS) instrument with the goal of measuring the reduced mobility (K_0) of compounds of interest, such as explosives and volatile standards, to an accuracy of $\pm 0.002 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$; an order of magnitude higher than the currently accepted level. A database of the K_0 's of compounds of interest under various temperatures, pressures, drift gas water content levels, and electric fields will be created and referenced by field deployed instruments in order to improve their own accuracy and reduce their false positive alarm rates.

Point of Contact

Dr. Dawanne Poree
ARO Program Manager and COR
Army Research Office
Research Triangle Park, NC 27709

Joint Publications

Peer Reviewed Publications (2 Total)

1. Brian C. Hauck, Eric J. Davis, Aurora E. Clark, William F. Siems, Charles S. Harden, Vincent M. McHugh, Herbert H. Hill Jr. **Determining the water content of a drift gas using reduced mobility measurements**, *International Journal of Mass Spectrometry*, **2014**, 368, 37-44.
2. Christina L. Crawford, Brian C. Hauck, Jessica A. Tufariello, Charles S. Harden, Vincent M. McHugh, William F. Siems, Herbert H. Hill Jr. **Accurate and reproducible ion mobility measurements for chemical standard evaluation**, *Talanta*, **2012**, 101, 151-170.

Oral Presentations (4 Total)

1. William F. Siems, Larry A. Viehland, Herbert H. Hill, Jr. **Validation of an Improved Momentum-Transfer Theory for Ion Mobility Using Accurate Kinetic Computations with Hard-Sphere and *Ab Initio* Potentials** 22nd *International Conference on Ion Mobility Spectrometry*; Asheville, North Carolina; July 27- August 1, 2014.
2. Brian C. Hauck, William F. Siems, Charles S. Harden, Vincent M. McHugh, Herbert H. Hill Jr. **Accurate Ion Mobility Spectrometry: Requirements and Results** 62nd *ASMS Conference on Mass Spectrometry and Allied Topics*; Baltimore, Maryland; June 15 -19, 2014.
3. Brian C. Hauck, William F. Siems, Charles S. Harden, Vincent M. McHugh, Herbert H. Hill, Jr. **Accurate Ion Mobility Spectrometry: Requirements and Results** *Trace Explosives Detection Workshop 2014*; Charlottesville, Virginia; April 7 -11, 2014.

4. Brian C. Hauck, William F. Siems, Charles S. Harden, Vincent M. McHugh, Herbert H. Hill Jr. **Accurate Ion Mobility Spectrometer** *22nd International Conference on Ion Mobility Spectrometry*; Boppard, Germany; July 20-26, 2013.

Poster Presentations (4 Total)

1. Brian C. Hauck, William F. Siems, Charles S. Harden, Vincent M. McHugh, Herbert H. Hill Jr. **Accurate Ion Mobility Spectrometer: Validation of Instrumental Parameters and Initial Results** *22nd International Conference on Ion Mobility Spectrometry*; Asheville, North Carolina; July 27- August 1, 2014.
2. Brian C. Hauck, William F. Siems, Charles S. Harden, Vincent M. McHugh, Herbert H. Hill Jr. **Accurate Ion Mobility Spectrometry: Technical Specifications** *62nd ASMS Conference on Mass Spectrometry and Allied Topics*; Baltimore, Maryland; June 15 -19, 2014.
3. William F. Siems, Larry A. Viehland, Herbert H. Hill, Jr. **Validation of an Improved Momentum-Transfer Theory for Ion Mobility Using Accurate Hard-Sphere Kinetic Computations** *62nd ASMS Conference on Mass Spectrometry and Allied Topics*; Baltimore, Maryland; June 15 -19, 2014.
4. Brian C. Hauck, William F. Siems, Charles S. Harden, Herbert H. Hill Jr. **Using Ion Mobility Measurements to Determine the Water Content of a Drift Gas in Ion Mobility Spectrometry** *Pittcon Conference & Expo*; Chicago, Illinois; March 5, 2014.

B. Industry Tech Transfers

None

C. Visits by PI (or students) to Army/DOD labs

June 19, 2014

Dr. Herbert Hill Jr. to Edgewood Chemical Biological Center

To report on the progress of the project, present updates on the construction of a second accurate IMS instrument and present initial data taken on the accurate instrument.

September 22, 2014

Dr. William Siems to Edgewood Chemical Biological Center

To examine ECBC's mass spectrometers to obtain information for transferring a second accurate IMS instrument to ECBC.

D. Visits by DOD Scientists to PI Lab

September 29 – October 2, 2014; Dr. Charles S. Harden

December 2 - 6, 2013; Dr. Charles S. Harden

December 4 - 6, 2012; Dr. Charles S. Harden and Vincent M. McHugh

E. Awards and Honors

Frank A. Fowler Endowed Graduate Fellowship for Chemistry, Washington State University, Pullman, WA (2014), to Brian Hauck

NASA Space Grant Consortium, Washington State University, Pullman, WA (2012), to Brian Hauck

F. Name of ARO-supported graduate students now employed by Army/DOD

Brian Hauck is still in progress of completing his PhD at Washington State University.