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Electron affinities from gas chromatography electron capture detector and negative ion mass spectrometry responses and complementary methods

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### Highlights

- Electron Affinities from gas chromatography electron capture detectors are reviewed
- New electron affinities from complementary methods are reported.
- The accuracy and precision of electron affinities from three methods are established
- Optimized procedures for analytical and physical measurements are presented

### Abstract:

The use of the electron-capture detector, ECD, to measure molecular electron affinities and kinetic parameters for reactions of thermal electrons with molecules at atmospheric pressure separated by chromatography and the sensitive and selective quantitative analysis of certain classes molecules are reviewed. The evaluated ground state electron affinities of the main group elements and diatomic molecules from slightly positive, 0+, to 3.6 eV are summarized. The electron affinities of twenty-seven superoxide states determined from pulsed discharge ECD and other methods are used to calculate one dimensional potential energy curves in agreement with theory. Advances in literature searches have uncovered ECD data in dissertations and theses and in the Russian and Japanese literature. These data, unpublished radioactive and pulsed discharge ECD thermal data from the University of Houston laboratories are used to report and evaluate electron affinities. The accuracy and precision of ECD electron affinities of organic molecules are identified and tabulated so that they can be added to compilations. A procedure for calculating the temperature dependence of electron molecule reactions is presented using kinetic and thermodynamic data. These are used to select the most appropriate equipment and conditions for ECD analyses and physical determinations.

Keywords: Electron Capture Detector; Negative Ion Mass Spectra; Temperature Dependence; Selective Detection; Electron Affinities

### 1. Introduction

More than a half century ago Lovelock and Lipsky identified peaks in gas chromatography with the electron-capture detector (ECD). [1] It is now used in many

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