

Low Energy Electron Collisions with Plasma Processing Gases – Data Compilations and Evaluations

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Gaseous electronics—the term which is loosely applied to describe low temperature discharge physics—is a broad and diverse area of research and development which encompasses both established and emerging technologies. These include semiconductor production, lighting, propulsion, environmental remediation, and materials processing, to name just a few.

Absolute electron-impact cross sections for molecular targets, including their radicals, are important in applications of gaseous electronics, such as the development of plasma reactors and testing various plasma processing gases. Low-energy electron collision data for these gases are in some cases quite sparse and only limited cross section data are available. In this work, elastic cross sections for electron collisions with a number of molecules relevant to plasma processing are reviewed. Elastic cross sections are essential for the absolute scale conversion of inelastic cross sections, as well as for testing computational methods. In this work data has been collected and reviewed for elastic differential, integral, and momentum transfer cross sections and, for each molecule, recommended values of the various cross sections are provided. The project encompasses data for more than 15 molecules and several radicals and selected examples will be presented in this presentation to illustrate the state of field.

We also highlight the comparison, where possible, with theoretical estimates of these cross sections. The strong rationale for this is that in many cases theory may be the only avenue to obtain cross sections, for reactive collisions for example, and elastic scattering measurements can provide a handy and accurate tool for benchmarking theory.