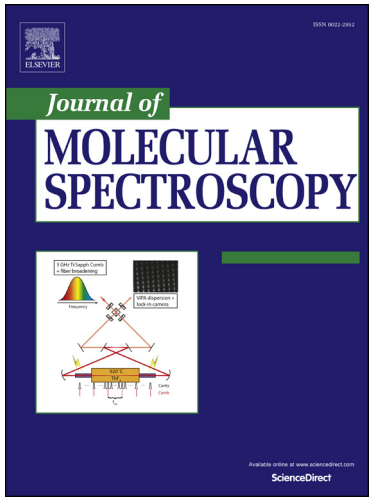
Accepted Manuscript



Infrared Emission Spectroscopy of Atmospheric-Pressure Ball Plasmoids

Scott E. Dubowsky, Bradley Deutsch, Rohit Bhargava, Benjamin J. McCall

PII: S0022-2852(16)30019-4
DOI: http://dx.doi.org/10.1016/j.jms.2016.02.005
Reference: YJMSP 10677

To appear in: *Journal of Molecular Spectroscopy*

Received Date: 29 September 2015
Revised Date: 30 January 2016
Accepted Date: 5 February 2016

Please cite this article as: S.E. Dubowsky, B. Deutsch, R. Bhargava, B.J. McCall, Infrared Emission Spectroscopy of Atmospheric-Pressure Ball Plasmoids, *Journal of Molecular Spectroscopy* (2016), doi: http://dx.doi.org/10.1016/j.jms.2016.02.005

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Infrared Emission Spectroscopy of Atmospheric-Pressure Ball Plasmoids

Scott E. Dubowsky[a], Bradley Deutsch[b], Rohit Bhargava[b], Benjamin J. McCall[c,*]

[a] *Department of Chemistry, University of Illinois, Urbana, IL, 61801, USA*
[b] *Department of Chemical and Biomolecular Engineering, University of Illinois, Urbana, IL, 61801, USA*
[c] *Departments of Chemistry and Astronomy, University of Illinois, Urbana, IL, 61801, USA*

Abstract

We report the first (to our knowledge) infrared emission spectra collected from water-based laboratory ball plasmoid discharges. A "ball plasmoid" results from a unique type of pulsed DC plasma discharge in which a sphere of plasma is seen to grow and eventually separate from a central electrode and last for a few hundred milliseconds without an external power source before dissipating. Typical recombination rates for plasmas at ambient conditions are on the order of a millisecond or less, however ball plasmoids have been observed to last a few hundred milliseconds, and there is no explanation in the literature that fully accounts for this large discrepancy in lifetime. The spectra are dominated by emission from water and from hydroxyl radical; PGOPHER was used to fit the experimental spectra to extract rotational temperatures for these molecules. The temperatures of the bending and stretching modes of H_2O were determined to be 1900±300 K and 2400±400 K, respectively and the rotational temperature of OH was found to be 9200±1500 K.

Keywords: Plasmoid, Plasma Diagnostics, Rotational Temperature, Infrared Emission Spectroscopy PGOPHER, Ball Lightning

1. Introduction

Low-temperature and atmospheric-pressure plasmas have developed as essential tools across several industries over the past few decades. The tunability of plasma discharge parameters allows for the selection of chemically and physically reactive components of the ionized medium, and operating a discharge at ambient pressures fosters numerous applications of plasmas in different settings.

*Corresponding author
Email address: bjmccall@illinois.edu (Benjamin J. McCall)

Download English Version:

https://daneshyari.com/en/article/5414257

Download Persian Version:

https://daneshyari.com/article/5414257

Daneshyari.com