TEMPERATURE DEPENDENCE OF THE COTTON-MOUTON EFFECT IN GASES

BY

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PREFACE

This thesis describes research undertaken at the University of New England, Armidale, under the supervision of Professor G.L.D. Ritchie.

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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SUMMARY

The Cotton-Mouton effect in gases can provide valuable information about certain fundamental molecular properties which determine the interaction of matter with electric and magnetic fields, and an analysis of such properties provides insight into the charge distributions and structures of molecules. In this thesis, improvements to apparatus designed and constructed for the purpose of measuring the temperature dependence of the Cotton-Mouton effect in gases and vapours of liquids are described. This apparatus is capable of determining the magnetic field-induced retardance at pressures up to $\approx$ 1000 kPa and over a temperature range of 260-500 K, and it incorporates an automated detection system offering a limit of resolution of 2×10^{-7} rad.

Measurements were performed on fifteen species: methyl fluoride, methyl bromide, and methyl iodide; acetylene; dimethyl ether, dimethyl sulfide, oxirane (ethylene oxide), furan, and thiophene; carbon dioxide, carbonyl sulfide, and carbon disulfide; ethane; pyridine; and ethylene. Reliable values for the magnetic hyperpolarizability anisotropy and, in conjunction with data from other methods, the elements of the polarizability or magnetizability tensors, and other related molecular properties, were derived and discussed for all of these species.

TABLE OF CONTENTS

Page