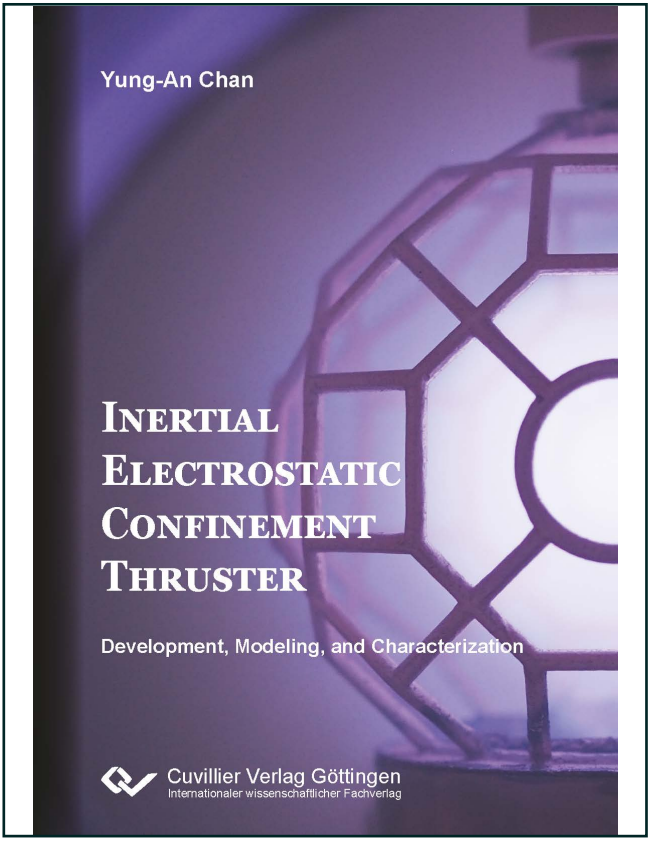
Yung-An Chan (Autor)

Inertial Electrostatic Confinement Thruster (IECT)

Development, Modeling, and Characterization



https://cuvillier.de/de/shop/publications/8696

Copyright:
Cuvillier Verlag, Inhaberin Annette Jentzsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany
Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: https://cuvillier.de

Contents

Acknowledgment ..... **i**

Abstract ..... **iii**

Zusammenfassung ..... **v**

Contents ..... **vii**

Nomenclature ..... **ix**

Chapter 1 Introduction **1**

1.1 Background of Inertial Electrostatic Confinement 1
1.2 Magnetic Nozzle for IEC Plasma Acceleration 6
1.3 Potential Applications 10
1.4 Motivation and Difficulties 11
1.5 Thesis Structure 12

Chapter 2 Fundamentals of DC Discharge and IEC Theory **13**

2.1 Fundamentals of DC Plasma Discharge 13
2.2 The New Perspective of the IEC Working Principle 23
2.3 Implementation of the IEC-SDL Model 29
2.4 Summary of IEC Discharge Theory 46

Chapter 3 Plasma Acceleration in Magnetic Nozzle **47**

3.1 Summary of the Plasma Transportation and MHD Flow Theory 47
3.2 Plasma Acceleration in a Divergent B-field 58
3.3 Plasma Detachment Mechanism 62
3.4 Design Criteria of MN for IEC Plasma Source 64

Chapter 4 IECT Design and Test Facility **83**

4.1 The Design Concept and Considerations of IECT 83
4.2 Phase I: IEC Discharge Experiment 87
4.3 Phase II: IECT Experiment 95
4.4 IECT Test Facility 98

Chapter 5 Plasma Diagnostics for IEC Plasma Sphere **107**

5.1 Narrow Spectral-bandwidth Imaging 107
5.2 Optical Emission Spectroscopy 110
5.3 Collisional Radiative Model 117

Chapter 6 Plasma Diagnostics for IECT Plume **129**

6.1 Principle of the Electrostatic Probe 130
6.2 Probe Design and Experimental Setup 137

Chapter 7 Discharge Evaluation of IEC Plasma Source 143
7.1 Discharge Behavior of IEC Plasma Source 143
7.2 SDL Characteristics 149
7.3 Conclusions of IEC Discharge Experiment 176

Chapter 8 EMN Discharge and Plume Characteristics 181
8.1 EMN Discharge Characteristics 182
8.2 IECT Plume Properties 191
8.3 Summary of EMN Discharge Characteristics and Plume Properties 207

Chapter 9 Conclusion 211
9.1 Discharge of IEC and SDL Theory 212
9.2 Plasma Confinement and Acceleration by EMN 214
9.3 Summary 217
9.4 Outlooks and Suggestions for IECT Development 217

Bibliography 219

Appendix 235