THÈSE PRESENTÉE A L'UNIVERSITÉ D'ORLÉANS
POUR OBTENIR LE GRADE DE
DOCTEUR DE L'UNIVERSITÉ D'ORLÉANS

PAR
Lou Grimaud

ÉCOLE DOCTORALE ÉNERGIE, MATÉRIAUX, SCIENCES DE LA TERRE ET DE L'UNIVERS

Discipline : Physique

Magnetic shielding topology applied to low power Hall thrusters

Soutenue Publiquement
Le 25 Octobre 2018 à 14h
Salle de conférence d'ICARE.

MEMBRES DU JURY :

- **Laïfa BOUFENDI - Professeur des Universités, GREMI, Université d'Orléans**
- **Laurent GARRIGUES - Directeur de Recherche, LAPLACE, Université de Toulouse**
- **Georg HERDRICH - Docteur Privatdozent, IRS, University of Stuttgart**
- **Stéphane BÉCHU - Directeur de Recherche, LPSC, Université de Grenoble**
- **Stéphane MAZOUFFRE - Directeur de Recherche, LPSC, Université de Grenoble**
- **Claude BONIFACE – Docteur Ingénieur propulsion électrique, CNES**

RÉSUMÉ

Hall thrusters are one of the most used rocket electric propulsion technology. They combine moderate specific impulse with high thrust to power ratio which makes them ideal for a wide range of practical commercial and scientific applications. One of their limitations is the erosion of the thruster walls which reduces their lifespan. The magnetic shielding topology is a proposed solution to prolong this lifespan.
In this research it is implemented on a small 200W Hall thruster. The low power magnetically shielded Hall thruster is compared with an identically sized unshielded one. The ion behavior inside the thruster is measured and significant differences are found across the discharge channel. Both thrusters are tested with classical BN-SiO2 and graphite walls. The magnetically shielded thruster is not sensitive to the material change while the discharge current increase by 25% in the unshielded one. The result is a maximum efficiency of 38% for boron nitride in the unshielded thruster but only 31% with graphite. The shielded thruster achieves a significantly lower efficiency with only 25% efficiency with both materials.

INSTITUT DE COMBUSTION AÉROTHERMIQUE
RÉACTIVITÉ ET ENVIRONNEMENT