IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

Author: Dr. Yasushi Ohkawa
JAXA, Japan, okawa.yasushi@jaxa.jp

Dr. Teppei Okumura
Japan Aerospace Exploration Agency (JAXA), Japan, okumura.teppei@jaxa.jp
Mr. Yuta Horikawa
Japan Aerospace Exploration Agency (JAXA), Japan, horikawa.yuuta@jaxa.jp
Mr. Yoshiyuki Miura
Japan Aerospace Exploration Agency (JAXA), Japan, miura.yoshiyuki@jaxa.jp
Ms. Satomi Kawamoto
Japan Aerospace Exploration Agency (JAXA), Japan, kawamoto.satomi@jaxa.jp
Mr. Koichi Inoue
JAXA, Japan, inoue.koichi@jaxa.jp

RESULTS OF FIELD-EMISSION CATHODE OPERATION ON THE H-II TRANSFER VEHICLE

Abstract

Active space-debris removal (ADR) from the crowded low-Earth orbits is an effective way to prevent the continuous growth of the debris population. Research and development of electrodynamic tethers (EDTs) for ADR has been conducted by JAXA. One of the essential devices of EDT systems is an electron emitter, which is used for supplying electrical current through the tether. A carbon-nanotube-based field-emission-cathode (FEC) has been studied in JAXA because of its simplicity and potential high performance.

To demonstrate the fundamental EDT technologies including the FEC, JAXA planned and conducted an on-orbit experiment of an EDT system on the H-II transfer vehicle 6 (HTV-6). This one-week experiment was conducted in January 2017 after the HTV-6 left the International Space Station.

Although the tether could not be deployed because of a mechanical malfunction, the FEC operated well without critical troubles throughout the mission period. All eight cathode units emitted electrons until the ending of the mission and the total operation time reached 50 hours. The maximum electron emission current was over 5 mA, which was the highest FEC emission current ever demonstrated in space to our knowledge.

In the one-week experiment on the HTV, we obtained various data on the FEC such as the electron emission characteristics depending on the HTV attitude, electron charging behavior of the HTV in accordance with the FEC operation, performance degradation in dense atomic oxygen environment, and so on. Detailed results and discussion are to be presented in the conference.