

Cathode Key Features

Radial Cold Cathode Features:

- ✓ Compact and lightweight cathode
- ✓ Seamless operation from 0 to 30 mA
- ✓ Efficient operation (30 W max.)
- ✓ No heater & no expellant

Compact Hollow Cathode Features:

- ✓ Miniaturized design
- ✓ Stable operation at variable emission currents (0.3 A – 2 A)
- ✓ Low power operation (< 30 W)
- ✓ Heater-less ignition & operation
- ✓ Low gas consumption
- ✓ High ignition cycling

Specifications	Radial Cold Cathode	Compact Hollow Cathode
Dimensions (DxL)	(\varnothing 26 x 60) mm	(\varnothing 35 x 31.5) mm
Net weight	< 50 g	200 g
Emitting Current Range	0 – 30 mA	0.3 A – 2 A
Gas consumption	-	< 4 sccm (Kr)
Efficiency / Power Consumption EOL	> 1 mA/W	< 30 W @ 0.6A
Lifetime	2000 h	> 950 h

Flat design and custom currents available too !

About us

Our development team with expertise in plasma physics and aerospace engineering has many years of experience in the development and operation of electric propulsion systems. From electrothermal, electrostatic, to electromagnetic thrusters, we delve into the intricacies of propulsion mechanisms. Situated in the laboratories of the Institute of Aerospace Engineering at Technische Universität Dresden in Germany, we are dedicated to the continual enhancement of propulsion technologies in space-like environments.

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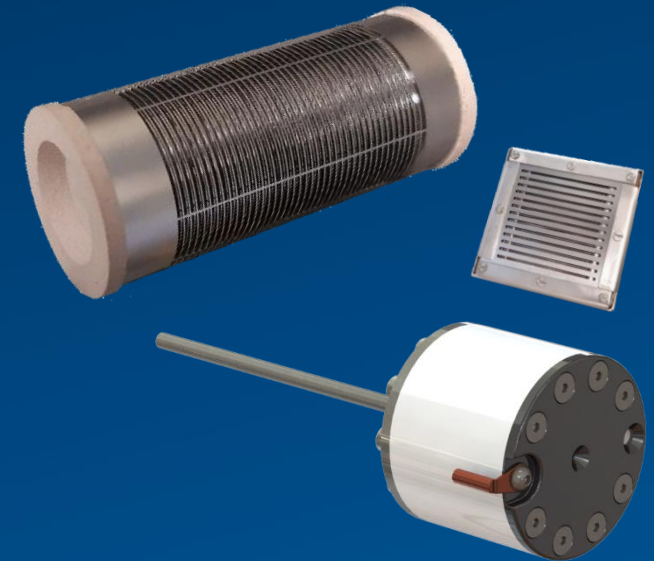
➤ tu-dresden.de/ilr/rfs/service?set_language=en

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Cold Cathodes & Compact Hollow Cathode

Power Efficient & Miniaturized
Electron Emitters based on new Materials for
Space Propulsion System and
Spacecraft Neutralisation

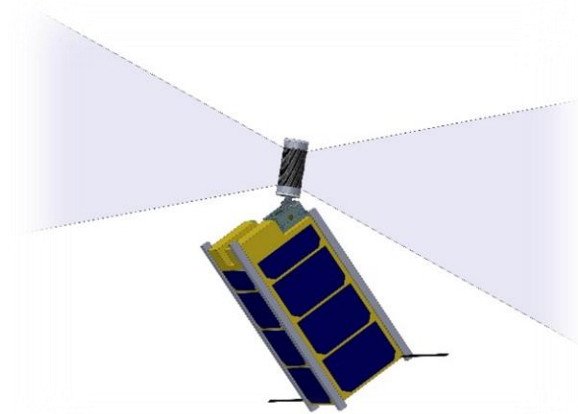


Institute of Aerospace Engineering

Radial Cold Cathode

The market for small satellites is steadily growing. There is increasing interest in deploying complex electric propulsion systems and Electrodynamic Tether Systems (EDT) on these platforms, which have limited energy and space availability. As traditional hollow cathodes are no longer practical for this application, we are developing large-scale field emission arrays based on CNTs to achieve the required high currents and efficiencies.

The radial cold cathode has been specifically **designed for use in EDT operation**. Its radial shape makes it compact and robust, ensuring optimal contact with the plasma. Another advantage of this technology is the continuously adjustable emission current.

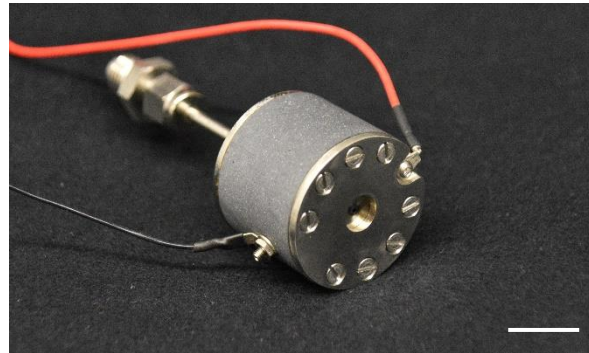


So far, stable operation has been demonstrated up to **30 mA** which can be scaled up to **100 mA**. The cathode's efficiency will fall below **1 mA/W** after **2000 hours** at maximum current.

We are able to build CNT cathodes in a **variety of shapes** with **customizable emission currents**.

Compact Hollow Cathode

Ideal for the use in Micro- or Smallsats, we have developed the Compact Hollow Cathode. It features a novel disc shaped emitter made of C12A7 electride. Compared to common hollow cathodes based on LaB₆ or BaO-W, the electride requires no additional heating for electron emittance due to its low work function – resulting in a modular and miniaturized design of the cathode with high reliability.



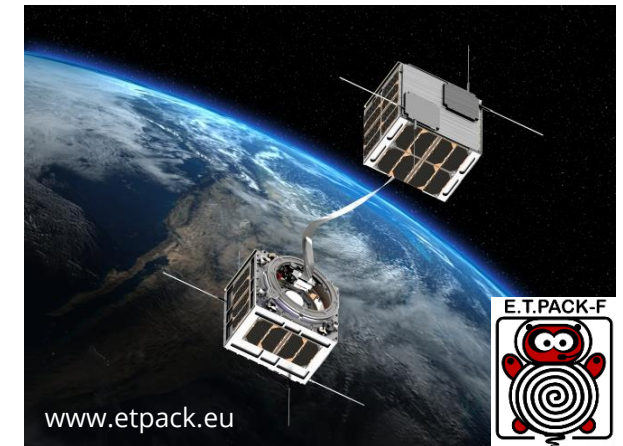
The cathode can stably emit up to **2 A of electron current** with mass flow rates **< 4 sccm of Krypton**, with ambitions to further lower the propellant consumption. Improvements on the emitting parameters of the cathode have also been achieved with the use of multi-orifice keepers.



Successful operation of the Compact Hollow Cathode as neutralizer has been verified in use with the inhouse 200 W Hall Effect Thruster.

The Compact Hollow Cathode was first developed as part of the FET Open Project E.T.PACK and the follow-up project E.T.PACK-Fly, funded by the European Union. Therefore, the cathode is optimized for low emission currents and overall low power requirements. In scope of the EDT project the cathode underwent thorough testing, verifying **long-term operation of more than 950 h and 500 ignition cycles** without significant performance degradation.

In scope of the E.T.PACK-Fly project, an In Orbit Demonstration (IOD) is planned by 2025, after which the cathode will reach TLR 9 with flight heritage.



The Compact Hollow Cathode's modular design enables the flexible and fast adaptation of each component to the specific needs of a customer, i.e. the spacecraft's mechanical and electrical interface. Additionally, the cathode can be supplied with custom electronics and custom propellant supply system on demand.

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