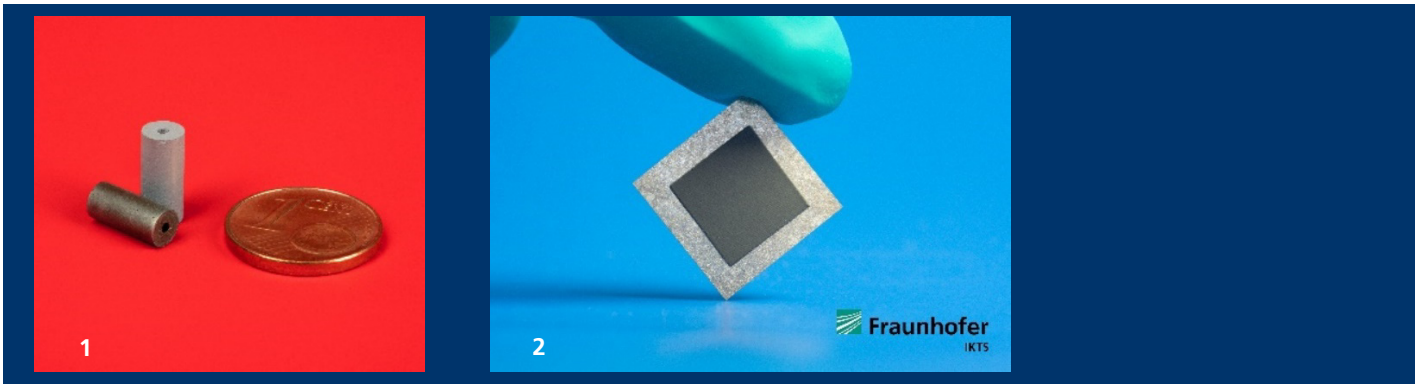
Fraunhofer
IKTS

FRAUNHOFER INSTITUTE FOR CERAMIC TECHNOLOGIES AND SYSTEMS IKTS



1 *Hollow cathodes of C12A7 before (white) and after sintering (black).*
2 *Powder-based C12A7 coating on metallic substrate.*

ELECTRON EMITTING C12A7 CERAMICS

Motivation

Electride materials are used as cathodes in electron-emitting assemblies, such as space propulsion systems of satellites or in thermionic converters. In the material development, the target is a low work function in order to achieve current densities in an electric field even at lower temperatures (< 1000 °C).

Results

The material C12A7 ($12CaO\text{-}7Al_2O_3$) can be produced with a work function of < 2.4 eV using ceramic technologies, which means that considerable current densities can already be measured at temperatures of < 1000 °C in vacuum [1]. The operation of a hollow cathode with a voltage of 2 V at a temperature of about 100 °C has been demonstrated over 1000 h in continuous process [2]. In the EU project iFACT (870336), ceramic hollow cathodes made of C12A7 are being developed for satellite propulsion (Fig. 1). A C12A7 coating is developed in the EU project E.T. Pack (828902), which is intended to enable disused satellites to be dropped from orbit without propulsion (Fig. 2).

Services offered

- Preparation of C12A7 electride ceramics with low work function < 2.4 eV
- Small series production in various geometries according to customer requirements
- Coating of C12A7 with thick-film technology (e.g. printing process)
- Characterization of electrical, mechanical and optical properties

References

Patent application: DE 10 2020 107 795.5
[1] A. Heiler, K. Wätzig, et al., J. Vac. Sci. Technol. A 39, 013002 (2021).
[2] C. Drobny, K. Wätzig, et al., Space Propulsion 2021 Conference, 00153 (2021).

Fraunhofer Institute for Ceramic Technologies and Systems IKTS

Winterbergstrasse 28
01277 Dresden
Germany

Contact

Dr. Katja Wätzig
Phone +49 351 2553-7877
katja.waetzig@ikts.fraunhofer.de

www.ikts.fraunhofer.de