

High-Accuracy Emissivity Data on Black Coatings for ESA's Ninth Earth Explorer Mission FORUM

Albert Adibekyan^{C, S}, Elena Kononogova and Christian Monte
AG 7.32 Infrarot-Strahlungsthermometrie, Physikalisch-Technische Bundesanstalt (PTB), Berlin, Germany
albert.adibekyan@ptb.de

Charlotte Pachot
Earth Observation Directorate, European Space Agency/ESTEC, Noordwijk, Netherlands

Bernardo Carnicero Domínguez
European Space Agency/ESTEC, Noordwijk, Netherlands

Daniel M. Peters and Dave Smith
Science and Technology Facilities Council, Didcot, United Kingdom

Edoardo Alberti and Philippe Giaccari
Micos Engineering GmbH, Dübendorf, Switzerland

Jörg Hollandt
Detector Radiometry and Radiation Thermometry, Physikalisch-Technische Bundesanstalt (PTB), Berlin, Germany

The Far-infrared Outgoing Radiation Understanding and Monitoring (FORUM) mission has been selected as ESA's ninth Earth Explorer mission within the ESA's Earth Observation Programme. The main aim of the project is determination of the Earth's top-of-atmosphere emission spectrum including, for the first time, the far-infrared spectral range. The measurements in the extended wavelength range from 6.25 μm to 100 μm will improve the understanding of the climate system and contribute to the full Earth radiation budget providing the most accurate climatological model.

The highly demanding uncertainty requirements of the FORUM mission lead to demanding radiometric and spectral requirement of an on-board calibration system. It consists of an infrared radiator with a large area and high effective emissivity. The properly selected black coating of the cavity suitable for the full FORUM spectral range and space environment plays a crucial role. Therefore high-accurate data of the optical properties of the coating, i.e. its emissivity, is mandatory.

The Physikalisch-Technische Bundesanstalt (PTB), as a partner within the FORUM mission, determined the directional spectral, directional total and hemispherical total emissivities of the potential coating candidates technically relevant for an in-flight blackbody: Nextel 811-21, Vantablack, Akhtar Ultra Black and Deep Sky Black. Here, emissivity data and extensive characterizations of these coatings measured during the Phase A, covering a wide wavelength range from 5 μm to 100 μm , will be presented with an associated measurement uncertainty.