

# Berlin Reflectance Spectral Library (BRS�)

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## Abstract

The Berlin Reflectance Spectral Library (BRS�) provides a collection of reflectance spectra between 0.3 and 17  $\mu\text{m}$ . It was originally dedicated to support space missions to small solar system bodies. Meanwhile the library includes selections of biconical reflectance spectra for spectral data analysis of other planetary bodies as well. The library provides reference spectra of well-characterized terrestrial analogue materials and meteorites for interpretation of remote sensing reflectance spectra of planetary surfaces. We introduce the BRS�, summarize the data available, and access to use them for further relevant applications.

## 1. Introduction

Laboratory spectra of minerals, mineral mixtures and meteoritic samples are the basis for analysis of remote sensing spectra, e.g., to study surface composition or surface texture. The spectral library was originally created as the Rosetta Spectral Library (RSL) and was constantly extended comprising data relevant to various space missions like the Dawn mission or ExoMars. The BRS� is a separate DLR library complementary to the Planetary Emissivity Library (PEL) [1].

## 2. Spectra and sample information

The BRS� provides reflectance spectra of different analogues (terrestrial minerals, rocks, refractory organic materials, and meteorites) for small bodies like comets or asteroids and planetary bodies like Mars and Mercury. The spectra cover the wavelength range between 0.3 and 17  $\mu\text{m}$ . Measurements at longer wavelengths are planned to be integrated in a next step. The spectral library includes spectra of bulk and powdered materials. The spectra were recorded at the Planetary Spectroscopy Laboratory (PSL) [1], the Infrared and Raman for Interplanetary

Spectroscopy (IR/IS) at the University of Münster and the Complex Irradiation Facility (CIF) [2] at the DLR Bremen. The samples are measured at biconical geometry with varying incidence and emergence angles.

A DLR ID number (PAM#, Planetary Analogue Materials) is assigned to each spectrum of an analogue material. It allows tracking all sample information, spectral data and the measurement path.

BRS� provides chemical analyses (RFA, XRD or microprobe) for all spectrally characterized samples.

Over 300 different analogue materials are currently available at the DLR laboratory in Berlin. They include various phyllosilicates, mafic minerals, synthetic Fe-free mafic silicates [3], sulfides, sulfates, carbonates, oxides, hydroxides, synthetic salts, organic materials like solid oil bitumens [4] and meteorites (in particular C-chondrites).

## 3. Structure of the spectral library

The BRS� is a Microsoft Access database continuously extended by recent laboratory spectral data. The spectral library is divided into two parts, the public one that contains the post-processed data for external users and the part two comprising the raw data accessible only for internal use or upon request. For the BRS� public part over 200 post-processed spectra are included so far. For internal use 2500 raw datasets are available. In addition, both parts provide sample information on grain size, sample origin, sample type, chemical composition and measurement set-up (instrument, incidence/emergence /phase angles, resolution). The internal part of the database includes more detailed information on a sample to track the preparatory path and sample storage as well as the complete measurement set-up (standard, beamsplitter,

detectors, scan number, filter, pre-amplifier and others).

A README file available to all users comprises relevant information on how to cite and use the BRSL. It summarizes details of the laboratory set-up (instrument description), the general database structure, the measurement standard set-up, and information on the general measurement procedure.

The data provided by BRSL are available in the standard file formats. Spectral reflectance data (pre- and post-processed) are available as ASCII-files. Reflectance spectra plots (Figure 1) are available as png-files. Sample images (Figure 2) are provided as jpeg-files. Chemical analyses are available as pdf- and ASCII-files (tables). The public part of BRSL will be accessible via the VESPA service at <http://vespa.obspm.fr/planetary/data/eprn/query/all/> to search and download the data. This service is provided by the Europlanet H2020 Research Infrastructure project funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208.

## 4. Conclusion and further work

The BRSL is a library of UV/VIS/IR reflectance spectra which provides a user with input data and sample information to support analysis of remote sensing reflectance spectra of solid solar system objects. The data sets are easily accessible and can be downloaded.

BRSL is complementary to the Berlin Planetary Emissivity Library (PEL) and complements existing databases with data relevant to small solar system bodies and dwarf planets.

The work on the spectral library is still ongoing and the dataset is continuously updated. Currently BRSL is optimized to follow user requests. By the end of June 2017, the spectral library will be implemented into the VESPA service and thus, available to interested public users.

## Acknowledgements

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## References

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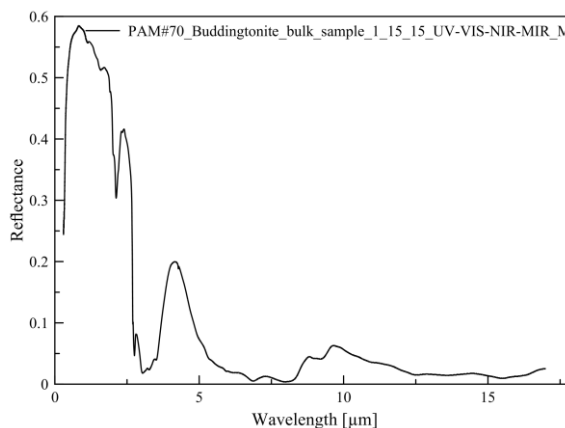


Figure 1: BRSL: Example of visualized reflectance spectrum. The figure shows a reflectance spectrum of buddingtonite (bulk sample) between 0.3 and 17  $\mu\text{m}$ .



Figure 2: BRSL: Example of sample image (corresponding to Fig. 1). The figure shows an image of a bulk sample of buddingtonite, an ammonium-feldspar.