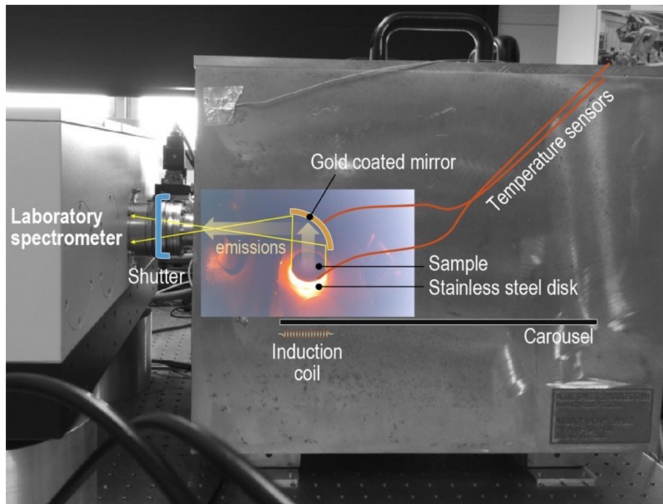


Venus Facilities Workshop for Mission Support

Venus Chamber Specification Form

1. Facility Name and Location:
Planetary Spectroscopy Laboratory (PSL)
located at the Institute for Planetary Research, DLR
Rutherfordstrasse 2, 12489 Berlin, Germany

2. Picture of chamber:



3. Point of Contact(s):
Dr. Alessandro Maturilli, Alessandro.maturilli@dlr.de, +49-30-67055-313
Dr. Jörn Helbert, joern.helbert@dlr.de, +49-30-67055-319
4. Internal Chamber Dimensions, including volume (metric system):
500mm x 400mm x 380mm (volume 0.076 m³)
5. Chamber Composition:
Stainless steel EN 1.4401
6. Maximum Pressure (bar):
N/A (This chamber uses a vacuum system to minimize sample alteration)
7. Maximum Temperature (°C):

Maximum temperature approx. 600°C

8. List gas species that can be used in an experiment:

N/A

9. Longest run time:

N/A

10. Window: Yes No

View port on top of the chamber is free view on the heated sample. Window is selectable, default is currently KRS5

a. Live video fee? Yes No

11. Electrical Feedthrough: Yes No

USB, Ethernet and 20 wires connection

12. Is temperature and pressure recorded in real time: Yes No

13. Gas Monitoring Capabilities: Yes No

N/AA

14. Gas boosting capabilities: Yes No

N/A

15. Planned Future Upgrades:

Second chamber, nitrogen purging system

16. Additional Capabilities (UV radiation, emissivity, internal scale, etc):

Measurement of emissivity from 0.8 μm to 200 μm

17. Can it be operated by an outside researcher (or only by someone at the facility)?

Yes No

About a week of training based on experience of researcher

18. General Cost of Operation per month:

Cost breakdown: *Cost and Maintenance fees:*

Labor Fees:

Gas cylinder purchases:

Equipment upgrades:

Additional costs:

19. Experiments:

- a. List previously conducted experiments

Example of some previous external researchers conducting Venu experiments at PSL:

Dr. Sara Port, at that time University of Arkansas, USA

Dr. Erika Kohler, at that time University of Arkansas, USA

Prof. Darby Dyar, Mount Holyoke College and PS, USAI

Prof. Molly McCanta, University of Tennessee, USA

Dr. Claudia Stangarone, University of Pavia, Italy

Dr. Sabrina Ferrari, University of Padova, Italy

- b. List future planned experiments

Dr. Erika Kohler, NASA Goddard Space Flight Center

Prof. Darby Dyar, Mount Holyoke College and PSI

Dr. Ann Carine Vandale, Royal Belgium Observatory

c. Have you supported/plan to support a mission? Yes No

i. Which mission(s)?

Venus mission supported:

ESA Venus Express

NASA VERITAS

ESA EnVision

JAXA Akatsuki

Support planned for

NASA DAVINCI

ii. What type of experiments (technology, geology, atmosphere, astrobiology, other)?

Spectral database, instrument development, instrument calibration, technology development

iii. How many hours have you dedicated/plan to dedicate towards mission work?

About 75% of the Venus chamber work at PSL is dedicated towards mission support

20. Approximate duration for the submission and approval of safety permits, if applicable

N/A

21. Provide a chamber website link, if available

22. If applicable, list all publications that reference the chamber

Some selected publications and conference abstract:

Helbert, J., et al. (2021). "Deriving iron contents from past and future Venus surface spectra with new high-temperature laboratory emissivity data." Science Advances 7.

Dyar, M. D., et al. (2020). "Probing Venus Surface Iron Contents with Six-Band VNIR Spectroscopy from Orbit." Geophysical Research Letters.

Dyar, M. D., et al. (2020). "Surface weathering on Venus: Constraints from kinetic, spectroscopic, and geochemical data." Icarus.

Ferrari, S., et al. (2020). "Thermal infrared emissivity of felsic-rich to mafic-rich analogues of hot planetary regoliths." Earth and Planetary Science Letters 534.

Kohler, E., Maturilli, A., Koulen, J., & Helbert, J. (2016), *AGU Fall Meeting Abstracts*, P23A-2165.

Helbert, J., Pertenais, M., Walter, I., Peter, G., Säuberlich, T., Cacovean, A., Maturilli, A., Alemanno, G., Zender, B., Arcos Carrasco, C., Dern, P., Pohl, A., del Togno, S., Rockstein, S., Rosas-Ortiz, Y., Rufini Mastropasqua, S., Wendler, D., Westerdorff, K., Réess, J.-M., Pechevis, E., Jerome, C., Buey, J. T., Widemann, T., Behnke, T., Wolff, F., Adeli, S., D'Amore, M., & Dyar, D. (2022), *The Venus emissivity mapper: implementation for flight on the NASA VERITAS mission*, *SPIE*, 10.1117/12.2634263, 12233, 1223302.

Smrekar, S., Hensley, S., Dyar, D., Whitten, J., Nunes, D., Helbert, J., Iess, L., & Mazarico, E. (2022), *VERITAS (Venus Emissivity, Radio Science, InSAR, Topography And Spectroscopy): A Selected Discovery Mission*, 44th COSPAR Scientific Assembly. Held 16-24 July, 44, 339.

Santos, A., Balcerski, J., Burr, D. M., Helbert, J., Hunter, G., Izenberg, N., Johnson, N., Kohler, E., Kremic, T., & Port, S. (2021), *The Importance of Venus Experimental Facilities*, *BAAS*, 10.3847/25c2cfcb.19b48da4, 53, 158.

Helbert, J., Dyar, M. D., Kappel, D., Maturilli, A., & Mueller, N. (2021), *Importance of Orbital Spectroscopy on Venus*, *BAAS*, 10.3847/25c2cfcb.62e629cb, 53, 066.

Helbert, J., Säuberlich, T., Dyar, M. D., Ryan, C., Walter, I., Reess, J.-M., Rosas-Ortiz, Y., Peter, G., Maturilli, A., & Arnold, G. (2020), *The Venus Emissivity Mapper (VEM): advanced development status and performance evaluation*, *SPIE*, 10.1117/12.2567634, 11502, 1150208.

Helbert, J., Vandaele, A. C., Marcq, E., Robert, S., Ryan, C., Guignan, G., Rosas-Ortiz, Y., Neefs, E., Thomas, I. R., Arnold, G., Peter, G., Widemann, T., & Lara, L. (2019), *The VenSpec suite on the ESA EnVision mission to Venus*, *SPIE*, 10.1117/12.2529248, 11128, 1112804.

Shinde, Satish, D'Amore, M., Maturilli, A., Varatharajan, I., & Helbert, J. (2019), *Spectroscopy of Fumaroles with Venus Emissivity Mapper Instrument Breadboard*, *EPSC-DPS Joint Meeting 2019*, 2019, EPSC-DPS2019-2021.

Helbert, J., Dyar, D., Walter, I., Wendler, D., Widemann, T., Marcq, E., Guignan, G., Ferrari, S., Maturilli, A., Mueller, N., Kappel, D., Jaenchen, J., D'Amore, M., Boerner, A., Tsang, C., Arnold, G. E., & Smrekar, S. (2018), *The Venus Emissivity Mapper (VEM): obtaining global mineralogy of Venus from orbit*, *SPIE*, 10.1117/12.2320112, 10765, 107650D.

Smrekar, S., Helbert, J., Hensley, S., & Dyar, D. (2018), *High Priority Decadal Survey Science from Orbit at Venus*, 42nd COSPAR Scientific Assembly, 42, B1.3-57-18.

Mueller, N. T., Smrekar, S., Helbert, J., Stofan, E., Piccioni, G., & Drossart, P. (2017), *Search for active lava flows with VIRTIS on Venus Express*, *Journal of Geophysical Research (Planets)*, 10.1002/2016JE005211, 122, 1021.

D'Incecco, P., Müller, N., Helbert, J., & D'Amore, M. (2017), *Idunn Mons on Venus: Location and extent of recently active lava flows*, *PSS*, 10.1016/j.pss.2016.12.002, 136, 25.

Helbert, J., Wendler, D., Walter, I., Widemann, T., Marcq, E., Guignan, G., Ferrari, S., Maturilli, A., Mueller, N., Kappel, D., Jaenchen, J., D'Amore, M., Boerner, A., Dyar, D.,

Arnold, G. E., & Smrekar, S. (2016), *The Venus Emissivity Mapper (VEM) concept*, SPIE, 10.1117/12.2237568, 9973, 99730R.

Stofan, E. R., Smrekar, S. E., Mueller, N., & Helbert, J. (2016), *Themis Regio, Venus: Evidence for recent (?) volcanism from VIRTIS data*, *Icarus*, 10.1016/j.icarus.2016.01.034, 271, 375.

Helbert, J., Maturilli, A., Ferrari, S., Dyar, M. D., & Smrekar, S. E. (2014), *First laboratory high-temperature emissivity measurements of Venus analog measurements in the near-infrared atmospheric windows*, *AGU Fall Meeting Abstracts, 2014*, P21B-3911.

Ferrari, S., Helbert, J., Maturilli, A., Dyar, D. M., Mueller, N., & Elkins-Tanton, L. T. (2014), *The Surface of Venus After VIRTIS on Venus Express: Laboratory Analogs and the Venus Emissivity Mapper*, *Workshop on Venus Exploration Targets*, 1781, 6016.

Mueller, N. T., Maturilli, A., Helbert, J., & Elkins-Tanton, L. T. (2013), *Igneous Rock Emissivity Measurements at High Temperatures in Support of Thermal Modeling and Infrared Imaging of Venus' Canali and Lava Flows*, *44th Annual Lunar and Planetary Science Conference*, 1932.

23. *Optional* If you have a blueprint that you would like to share, please upload it here or attach it to this document.

