Master Thesis

The degeneration of Indium vacuum seals due to Rubidium vapor

Basics:

Quantum physics is becoming more and more attention from science and economy. Often alkali-metals evaporated in an ultra-high vacuum (UHV) are used as source for quantum technologies. Additionally, optical accesses are used to introduce light fields to the atoms. Due to high thermal and/or high vibrational loads on the UHV seals, build by indium wire, the window seals are degenerating. This causes unwanted leaks to the vacuum system.

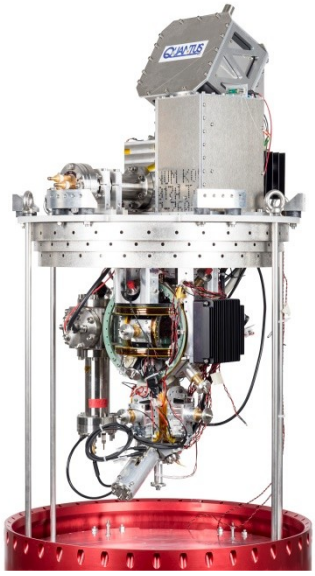

Figure 1: MAIUS Payload that uses Indium sealed UHV windows

Topic of the project:

Enabling technologies for quantum physical experiments is a completely new field for engineers. As developer of quantum physical experiments on-board of sounding rockets (MAIUS I & II) and the International Space Station (BECCAL) the ZARM is having major expertise for quantum technologies. In the framework of MAIUS and BECCAL the testing of performance and reliability of alkali-metal sources is crucial for the success of the missions.

In this thesis the student shall assemble UHV suitable windows with indium, lead and gold in accordance with the schematic for assembling UHV components. A test bench to artificially create the environment of the bake-out scheme and for the shaker test shall be designed and set up. From here the thesis shall focus on reproducing the degeneration of the indium seal with different scenarios, while observing the seal after each step with 3D-microscopy.

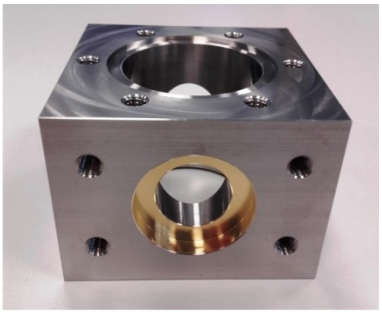

Figure 2: UHV chamber prototype for sealing technologies

We are looking for students with:

- Good knowledge in CAD (e.g. Autodesk Inventor…)
- Good knowledge of Physics (e.g. spectroscopy…)
- Basic knowledge of programming (e.g. Python, LabView)
- Experience with electrotechnic (e.g. oscilloscopes, photodiodes…)

We offer:

- Equipped laboratory
- Direct Support
- Participation in our DLR/NASA projects

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