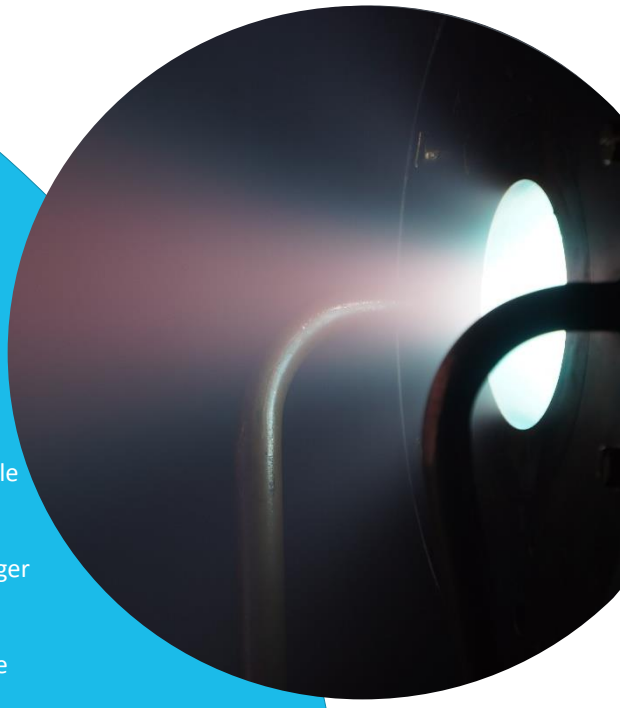
University of Stuttgart
Institute of Space Systems

Bachelor's Thesis

Plasma-based Extraction of Solid Carbon from Atmospheric CO_2



Starting Date: flexible

Motivation:

Since the pre-industrial era, human activities have caused a significant and measurable global warming. The mitigation of climate change is one of the world's most pressing near-future problems. While renewable energy and battery-electric transportation receive much attention these days, the need for cross-sectoral carbon removal is bigger than ever. The general concept behind this is the use of available renewable excess power for the conversion of atmospheric CO_2 into carbon and oxygen, either for re-utilization or sequestration. This way, circular or even carbon-negative economies are possible.

In the last years, the plasma-assisted reduction of CO_2 has gained interest due to its potential of efficient carbon dioxide dissociation. The inductive plasma generator IPG4 at the Institute of Space Systems (IRS) is a high-power plasma source, which can be operated with various gases and gas mixtures, especially oxygen and CO_2. Currently, IPG4 used to investigate the plasma-based dissociation of CO_2 for greenhouse gas recycling.

In this work, the performance of carbon removal using plasma technology shall be evaluated against existing strategies. Subsequently, a concept for solid carbon extraction from the IPG4 plasma jet shall be developed. Finally, the concept shall be demonstrated in a plasma wind tunnel experiment.

Task:

- Literature review on existing carbon removal strategies
- Formulation of performance parameters for a plasma-based CO_2 to carbon process
- Development of an extraction concept applicable to plasma generator IPG4
- Concept demonstration in a plasma wind tunnel experiment
- Documentation

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