STSE report

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Work package Title: Empowering the experimental and scientific capacitation of ESRs	
Responsible Author: Leandro Gomes	
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Legal Disclaimer

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1. Work location

The internship was realized in Lab 03 “High Pressure Laboratory” in Karlsruhe Institute of Technology, locate in Engler-Bunte-Institute/Fuel Technology, in Engler-Bunte-Ring 1, in Karlsruhe, Germany (Postal code 76131).

2. Main goal

The activity aimed to study the effects of the stirrer speed in the formation of Fischer-Tropsh wax.

3. Activities

3.1. Open Calls

Research regarding the open calls in which KIT and IPP can apply together was performed. Most of the open calls were related to the year 2022/2023, leaving a short time until the deadline.
Three calls related to 2023/2024 were also presented, leaving an opportunity to prepare and submitted a joint project.
A bilateral program named “Programme for Cooperation in Science between Portugal and Germany” which involves FCT (Fundação para Ciência e Tecnologia - Portugal) and DAAD (Deutscher Akademischer Austauschdienst) was also presented, to allow the exchange of students between countries.
The programmes of Erasmus+ and Brisk2 were also brought into discussion.

3.2. Laboratory and main experiment

During the internship at KIT, some essential laboratory activities were performed, such as the change of gas reservoirs and the inventory of chemicals in the laboratory.

First, before proceeding with the experiment, first an introduction of safe procedures in the Laboratory was presented by the tutor in Karlsruhe, Ph.D. Student Philipp Graefe.
Next, the Fischer-Tropsh plant was presented. First, a blank test was realized to evaluate if any reaction would be detected between the bed and the catalyst. The bed was composed with 300ml of Squalane ($C_{30}H_{62}$), and as a catalyst, 10g (Fe-K-Cu/Al_2O_3). The experiment started under pressure of 25 bars and 250°C, using N_2. After the reaction, the samples were

collected from the hot phase, and the cold phase to be analysed through GC (gas chromatography).

After the first procedure, the plant was cleaned, and another blank trial was made. This time, without the utilization of a catalyst and under the same pressure and temperature conditions, syngas (H_2, CO, and CO_2 in 66, 16, and 16% respectively) was applied in the reactor to evaluate if any reaction would occur between the reactors be (squalene). After the trial proceed the samples were collected in the hot and cold phase to be analysed.

After the realization of the blank tests, the campaign started, evaluating the amount and composition of samples from both hot and cold phase when the stirrer speed varies, from 200 to 1200 rpm.

Some parameters from the final gases were analysed in real time, such H_2O%, Trm%, temperature, and pressure (Mettler Toledo GPro500), the CO, and CO_2 (ABB AO2020), and the entire gas composition using Online-GC (Shimandzu Nexis GC-2030).

The collected liquid samples were analysed in Lab 203 “Brennstofflabor 2”, using a GC equipment (Shimandzu, Nexis OC-2020), and compared with pure squalene. The samples were prepared and analysed also comparing different solvents (Chloroform and Cyclohexane) in a ratio 20:80.

The need to test the hot and cold phase samples, are related to the final composition of the products of the Fischer-Tropsh plant. At the established pressure and temperature, hydrocarbons containing a long carbon chain are collected from the hot phase in a liquid phase. Some squalane ($C_{30}H_{62}$) is also collected in this step. Hydrocarbons with a smaller carbon chain are gaseous in the established conditions. Seeking to collect these products, the gaseous mixture is submitted to a condensation process being also collected in a liquid phase, but in the cold phase.

2. Photo register