Master Thesis in Combustion Fundamentals Group (CFG)

Within the European Union project **H**ybrid **R**enewable energy **C**onverter for continuous and flexible power production (HRC-Power), experiments and simulations are planned to determine the combustion stability envelope of a hydrogen-fueled catalytic microreactor. The microreactor, which has already been built in co-operation with other project partners, comprises a SiC ceramic block (size 30x30x4 mm^3) with six embedded cylindrical straight channels (30 mm in length and 1.5 mm in diameter) coated with platinum. Catalytic combustion of hydrogen/air mixtures inside the six channels yields temperatures at the outer SiC surfaces (30x30 mm2) in excess of 1000°C. Optimization of the six channel flows (co-flow or counterflow arrangements) will determine the design with the most uniform surface temperatures, a key requirement for the later application of the microreactor to a hybrid (combustion/solar) power generation system.
Within the Master's thesis work, goal is to investigate the combustion stability of hydrogen/air mixtures in the optimized reactor flow configuration. Combustion stability will be experimentally determined by flowing two streams of room-temperature air over the 30x30 mm^2 SiC block surfaces during combustion, and determining the maximum cooling air flow rate that allows sustained combustion without extinction of the chemical reactions. All experiments will be performed at CFG in a dedicated test rig. Numerical simulations will also be carried out using the 3D OpenFOAM software in conjunction with CFG's reactive codes for the catalytic channels.

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