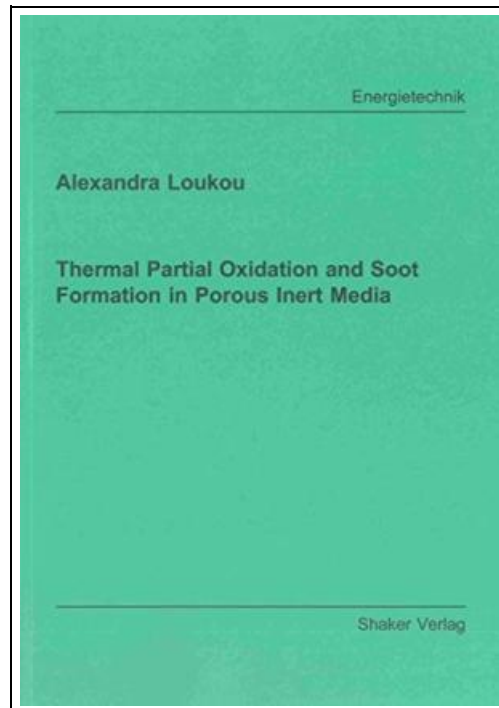


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Shaker Verlag Mrz 2014, 2014. Buch. Condition: Neu. Neuware - This thesis investigates the production of syngas from rich methane / air mixtures. The examined process is based on partial oxidation that was experimentally carried out without the use of catalysts. In order to overcome technical difficulties arising from catalyst exclusion, the process was studied using porous media based reactors. The employed porous media are inert ceramic materials, which promote internal heat recirculation within the reaction zone and consequently, superadiabatic combustion. Unlike other porous media based reformers, an important feature of the examined reactor is the ability to operate on the basis of stationary flames. For testing purposes, different reactor prototypes were constructed using different types of porous media, namely 10 ppi SiSiC reticulated foams and packing material (Raschig rings) out of high alumina (> 97% Al₂O₃). The analysis of the experimental results was supported by numerical simulations with a quasi-1D model, which takes into account the gas and solid-phase energy balances, convective heat transfer between gas and solid phases, solid-phase radiation, and detailed chemistry for combustion. The obtained experimental results demonstrate that the reactor is capable of stationary operation with preheated rich methane / air mixtures, for a wide range of thermal loads and equivalence ratios. This is a significant advantage with regard to its practical application, which is pertinent to the field of fuel cells, and particularly to SOFC based micro-CHP systems. The highest reforming efficiencies were recorded in the case of the SiSiC foam based prototypes, which reached 70% taking into account both H₂ and CO streams in the syngas. The efficiency of the Al₂O₃ packed bed prototype was lower (62%) but the application of this material was found to be very advantageous as far as reactor robustness is concerned. Peak temperatures measured within the porous zone provide...



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