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# UTILIZATION OF SYNGAS-FUELED ROTARY ENGINE FOR REMOTE POWER GENERATION*

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Reciprocating internal combustion engines represent well-established technology of syngas utilization for decentralized energy generation [1,2]. In this study the possibilities of the rotary engine fueled by syngas, produced on a large scale from various feedstocks by mature technologies were investigated. The four technologies of syngas production were chosen in order to understand the suitability of syngas in rotary engines. The catalytic steam methane reforming (Syn 1) and non-catalytic partial oxidation (Syn 3) are considered since the natural gas is the dominant feedstock for the industrial production of syngas. The syngases produced from biomass (Syn 4) and coal (Syn 2) through gasification are also investigated. The three-dimensional simulation of working progress in the engine was based on the finite volume method.

The temperature distribution in combustion chamber for different fuels at stoichiometric conditions was shown in Fig. 1. The common complex structure with asymmetric large-scale vortex near to the side housing of the engine (green lines) can be revealed.

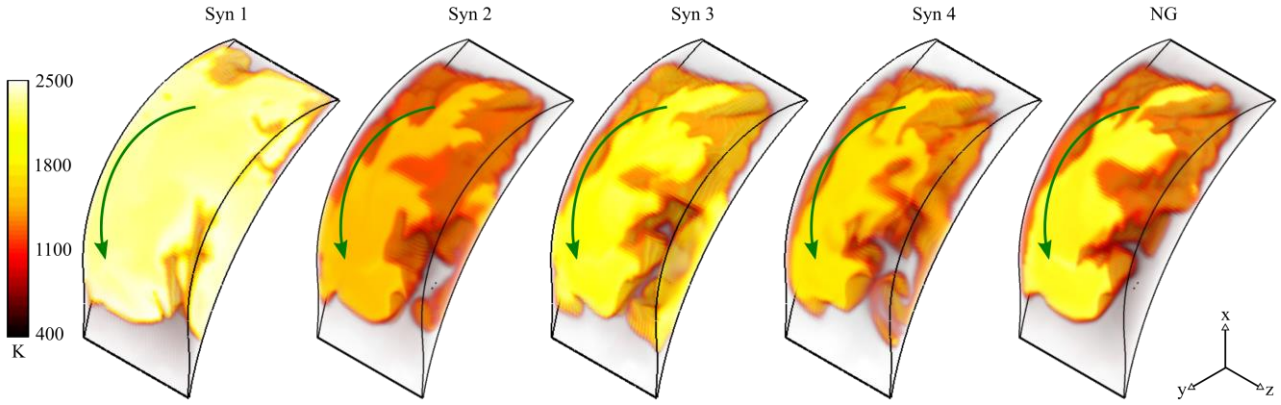


Fig.1. Temperature distributions in combustion chamber of rotary engine.

It was shown that employment of syngas in the energy sector could provide a solid basis for a circular self-sustaining economy and have important social and economic implications. The rotary engine with Syn 1 is expected to have high power characteristics due to high hydrogen concentration, as well as the possible $NO_X$ emission due to high combustion temperature. The engine performance fueled by Syn 2 is expected lower in comparison with Syn 1 fueling as a consequence of lower hydrogen content. Also, the carbon dioxide dilution can result in high $CO_2$ emission compared to other syngas types. The syngases produced with an air gasifying agent are expected to provide similar power and emission characteristics. Nitrogen addition and lower $H_2$ concentration in syngas produced from natural gas by non-catalytic partial oxidation and syngas produced by biomass gasification have an inhibiting effect on efficiency with a drastic decrease at lean conditions.

The use of syngas in a rotary engine can be considered as a valid method of electricity, power and heat production. The choice of appropriate production technology depends on the local availability of resources without excessive transportation costs. Syngas power generation system can provide environmental sustainability to the industry and reduce the external demand of energy carriers. The results of this work can be useful for further optimization to work with various types of syngas.

## REFERENCES

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