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CFD Simulation of Biomass Pyrolysis Syngas vs. Natural Gas in a Microturbine Annular Combustor

Biomass to energy conversion is particularly attractive on the microscale where internal combustion engines such as microturbines may be utilized coupled to an indirect gasification system. The authors have developed the IPRP technology based on rotary kiln pyrolysis and a pilot plant was built in Italy powered by an 80 kW_{el} microturbine fired by pyrolysis biomass syngas. This paper describes CFD numerical investigations carried out to study the combustion process occurring inside the annular rich-quick-lean combustion chamber of the given microturbine. A RANS analysis has been performed in order to simulate both natural gas and syngas combustion. A mechanism based on two reduced and detailed chemical kinetic were taken into account and applied to carry out the CFD simulations. The numerical results obtained for NG are presented and compared with the experimental data on emission to validate the numerical assumptions. The combustion mechanism are used also in pyrolysis gas combustion case to investigate the operation of the microturbine fuelled with this biomass derived fuel.

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Conference Location:

Glasgow, UK

Rights:

2010 ASME

Pages:

649-658

Conference Date:

Monday, June 14, 2010

Paper Reference:

GT2010-23473

Volume:

1

DOI:

<http://dx.doi.org/10.1115/GT2010-23473>

Conference Name:

ASME Turbo Expo 2010: Power for Land, Sea and Air

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Source URL: http://www.cd-adapco.com/conference_proceeding/cfd-simulation-biomass-pyrolysis-syngas-vs-natural-gas-microturbine-annular

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