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Electric Field Impact on the Biomass Gasification and Combustion Dynamics

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Abstract : Experimental investigations of the DC electric field effect on thermal decomposition of biomass, formation of the axial flow of volatiles (CO, H2, CxHy), mixing of volatiles with swirling airflow at low swirl intensity (S ≈ 0.2-0.35), their ignition and on formation of combustion dynamics are carried out with the aim to understand the mechanism of electric field influence on biomass gasification, combustion of volatiles and heat energy production. The DC electric field effect on combustion dynamics was studied by varying the positive bias voltage of the central electrode from 0.6 kV to 3 kV, whereas the ion current was limited to 2 mA. The results of experimental investigations confirm the field-enhanced biomass gasification with enhanced release of volatiles and the development of endothermic processes at the primary stage of thermochemical conversion of biomass determining the field-enhanced heat energy consumption with the correlating decrease of the flame temperature and heat energy production at this stage of flame formation. Further, the field-enhanced radial expansion of the flame reaction zone correlates with a more complete combustion of volatiles increasing the combustion efficiency by 3 % and decreasing the mass fraction of CO, H2 and CxHy in the products, whereas by 10 % increases the average volume fraction of CO2 and the heat energy production downstream the combustor increases by 5-10 %

Keywords : biomass, combustion,electrodynamic control, gasification
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