Air-blown entrained flow gasification of biomass has the potential of overcoming tar-related problems that occur in fixed bed or fluidized bed gasifiers. For designing entrained flow reactors (EFR), specific information on the gasification behavior of the fuel is required. Therefore, experiments with biocoal from the hydrothermal carbonization of different feedstock (beech, biogenic residuals, municipal waste, and green waste) are performed under EFR conditions and compared to lignite. Pyrolysis chars from biocoals and lignite are obtained in EFR at 900–1300 °C for a reactivity analysis. Intrinsic reaction rates of the char reactions with CO2, H2O and O2 are measured in a thermogravimetric analyzer. Compared to lignite, chars from biocoal are less reactive due to smaller surface areas and less catalytic ash constituents. Char samples from gasification with varying air/fuel equivalence ratios, λ, and residence times are sampled from an autothermal gasifier and from a laboratory-scale EFR at 900–1300 °C. Carbon and overall conversions are determined by means of the ash-tracer method. The evolution of particle size, surface area, and density of the chars with increasing conversion is measured, and simple model approaches are applied to describe
the observed behavior. The results show that fuel properties and gasification conditions significantly influence the prevailing reaction regimes and require particular consideration.