Thermal fractionation and catalytic upgrading of lignocellulosic biomass to biofuels

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Although multi-stage thermal decomposition with catalytic upgrading has a number of advantages over conventional single-stage pyrolysis with hydrotreating, significant gaps still exist in our understanding of the design of such processes. In this paper, we synthesize alternative catalytic upgrading strategies through integration of different chemistries. Using experimental data, we develop a detailed process model for all strategies and conduct heat integration to minimize utility requirements. Then, using a wide range of technoeconomic analyses, we identify (1) the relationship between process complexity and the resulting fuel-range carbon yields and economic feasibility, (2) the economic advantage of integrating different thermal decomposition fractions, and (3) the key cost drivers of the integrated processes.