Working Fluids for ORC Processes

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Electricity is generated mostly from fossil fuel which contribute largely to the global warming by carbon dioxide emission. Thus, the generation of electricity from renewable sources as, e.g., solar, geothermal, biomass, or waste heat, is desirable. Vapor turbine Rankine cycle processes are used for the generation of electricity from fossil fuel. An Organic Rankine Cycle (ORC) process, which uses organic working fluids instead of water, is proposed for electricity generation from renewable sources at low to medium temperature level.

Existing ORC units use a limited number of working fluids as ,e.g., perfluorinated n-pentane, which has a very high global warming potential, for low temperature heat or siloxanes for medium temperature heat. Especially at medium temperatures (200-300 ^{o}C), the stability of working fluids is a problem. Here, the BACKONE equations of state were used to screen pure and mixed fluids as potential working fluids for the ORC process. The thermal efficiency, turbine performance, and use of the source heat in the evaporator are calculated and compared.

The BACKONE equations of state have already been used successfully for the screening of alternative refrigerants and the description of natural gas. They are able to describe most possible, pure and mixed, working fluids with high accuracy, even if only little experimental data is available.