A thermo chemical model of a reforming process using hydrocarbon fuels which is included in a fuel cell system

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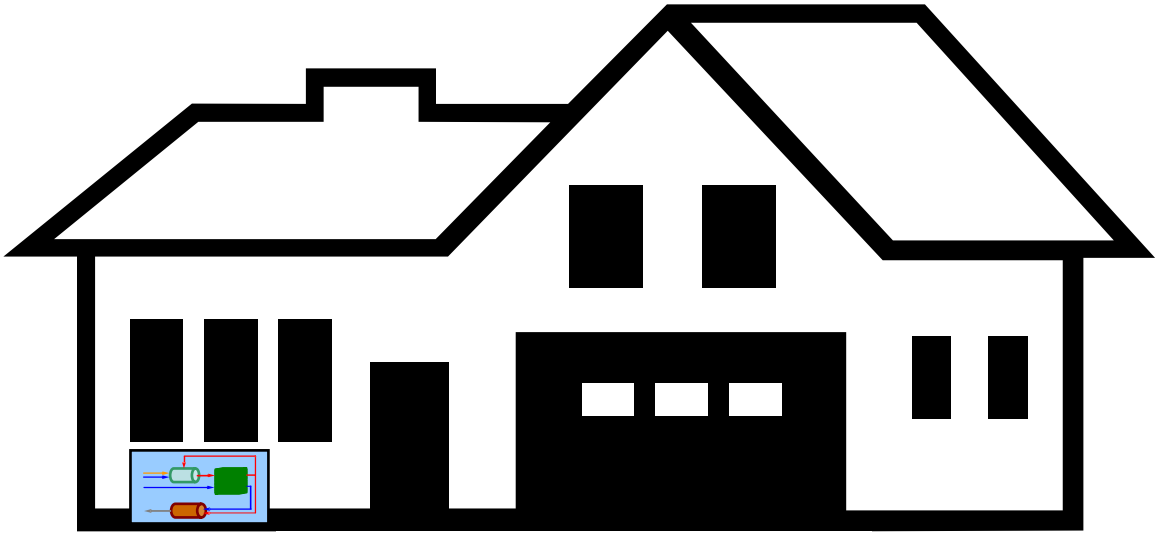
Application Area of the CPO-SOFC-System



stationary fuelcell
block heat and power plant

- in areas with poor infrastructure
- supply of electrical power and heat

auxiliary power unit (APU)

- generates power independent from the engine (no idle-mode)
- air conditioning while the trucks are standing

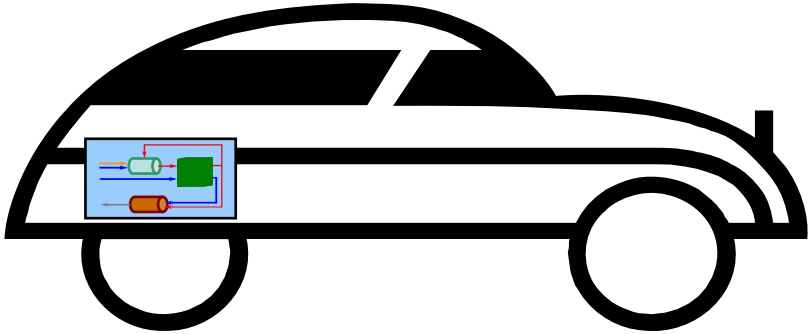
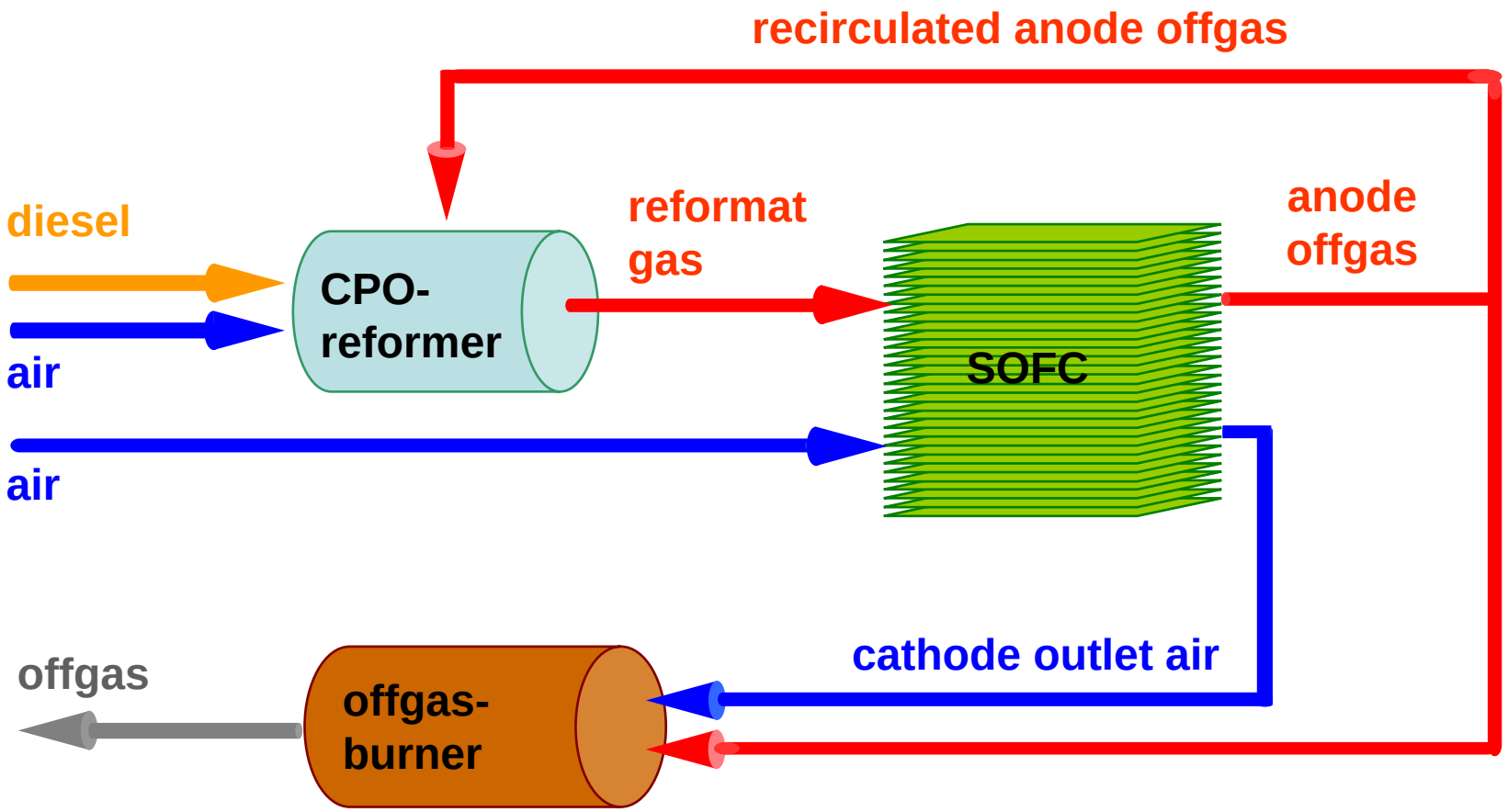
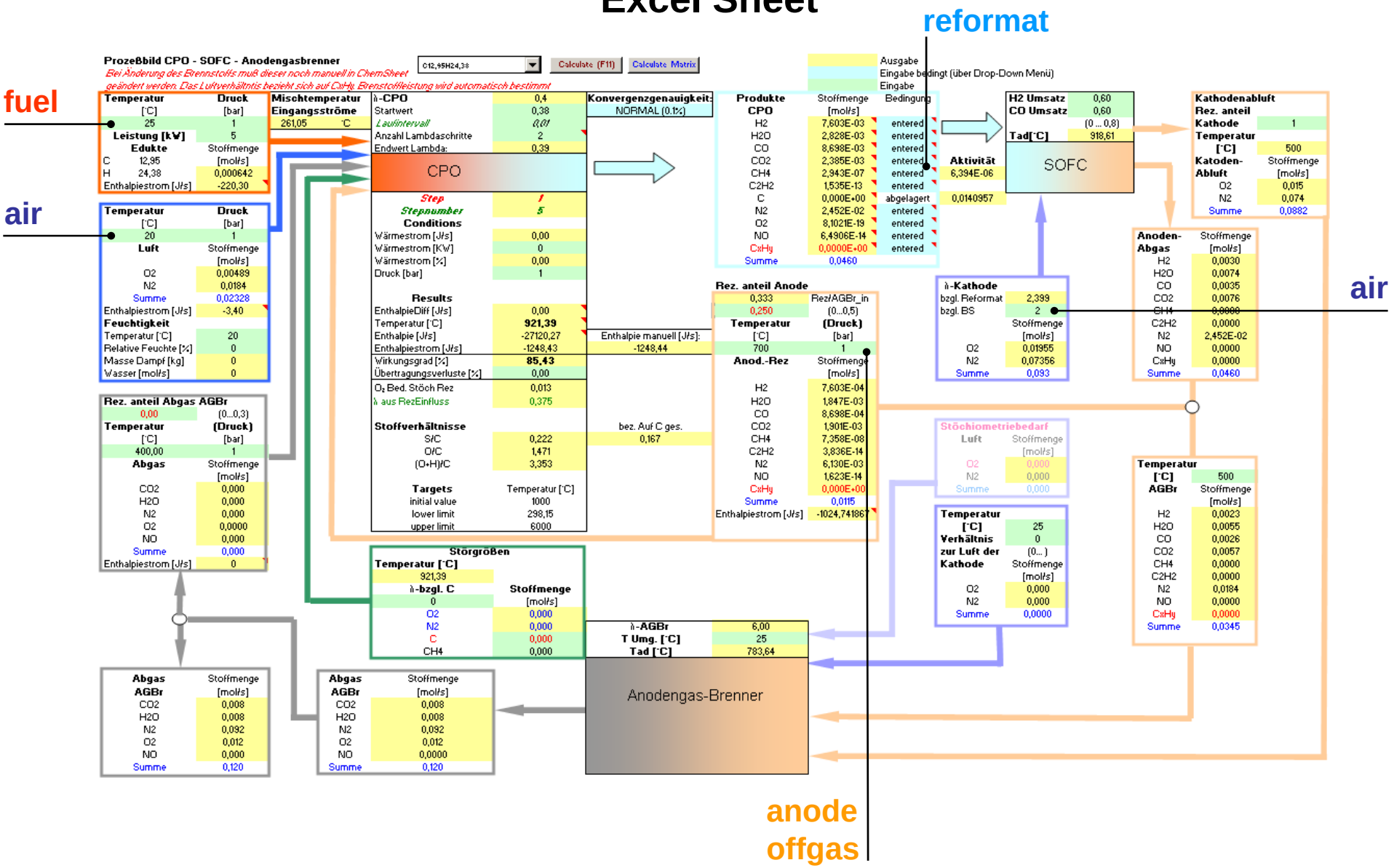


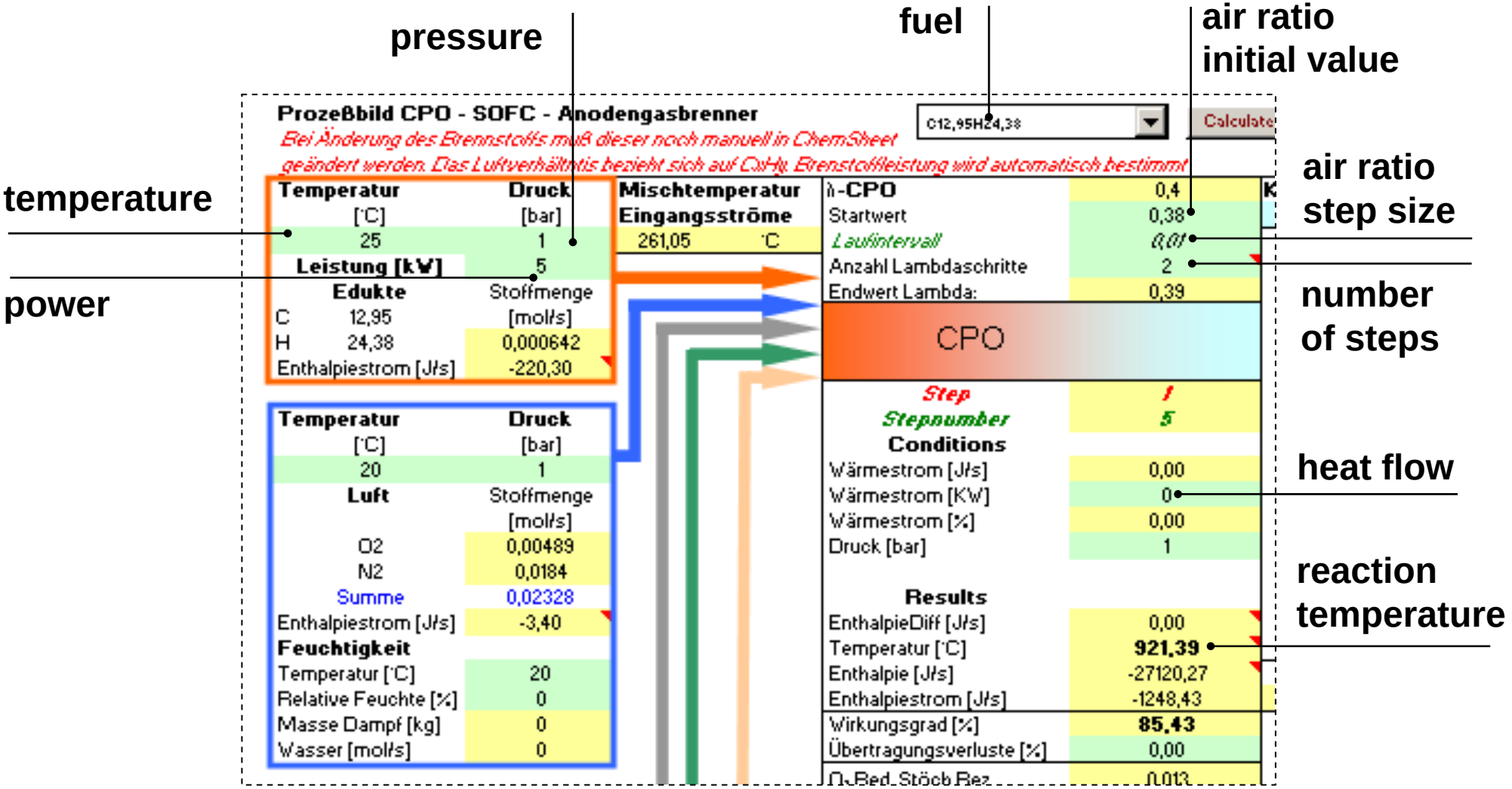
Diagram of Process



Excel Sheet


reformat
fuel
air
air
anode
offgas
ProzeBbild CPO - SOFC - Anodengasbrenner
Bei Änderung des Brennstoffs muß dieser noch manuell in ChemSheet
geändert werden. Das Luftverhältnis bezieht sich auf CxHy. Brennstoffleistung wird automatisch bestimmt
Calculate (F11)
Calculate Matrix
Ausgabe
Eingabe bedingt (über Drop-Down Menü)
Eingabe
CPO
SOFC
Anodengas-Brenner
Rez. anteil Anode
Rez. anteil Abgas AGBr
Störgrößen
Stöchiometriebedarf
Kathodenabluft
Anoden-Abgas
Abgas AGBr
Konvergenzgenauigkeit
NORMAL (0.1%)
Enthalpie manuell [J/s]:
bez. Auf C ges.
Aktivität
H2 Umsatz
CO Umsatz
Tad[°C]

Excel Sheet – Input Stream Fuel and Air



Excel Sheet – Products Reformat

quantity of materials

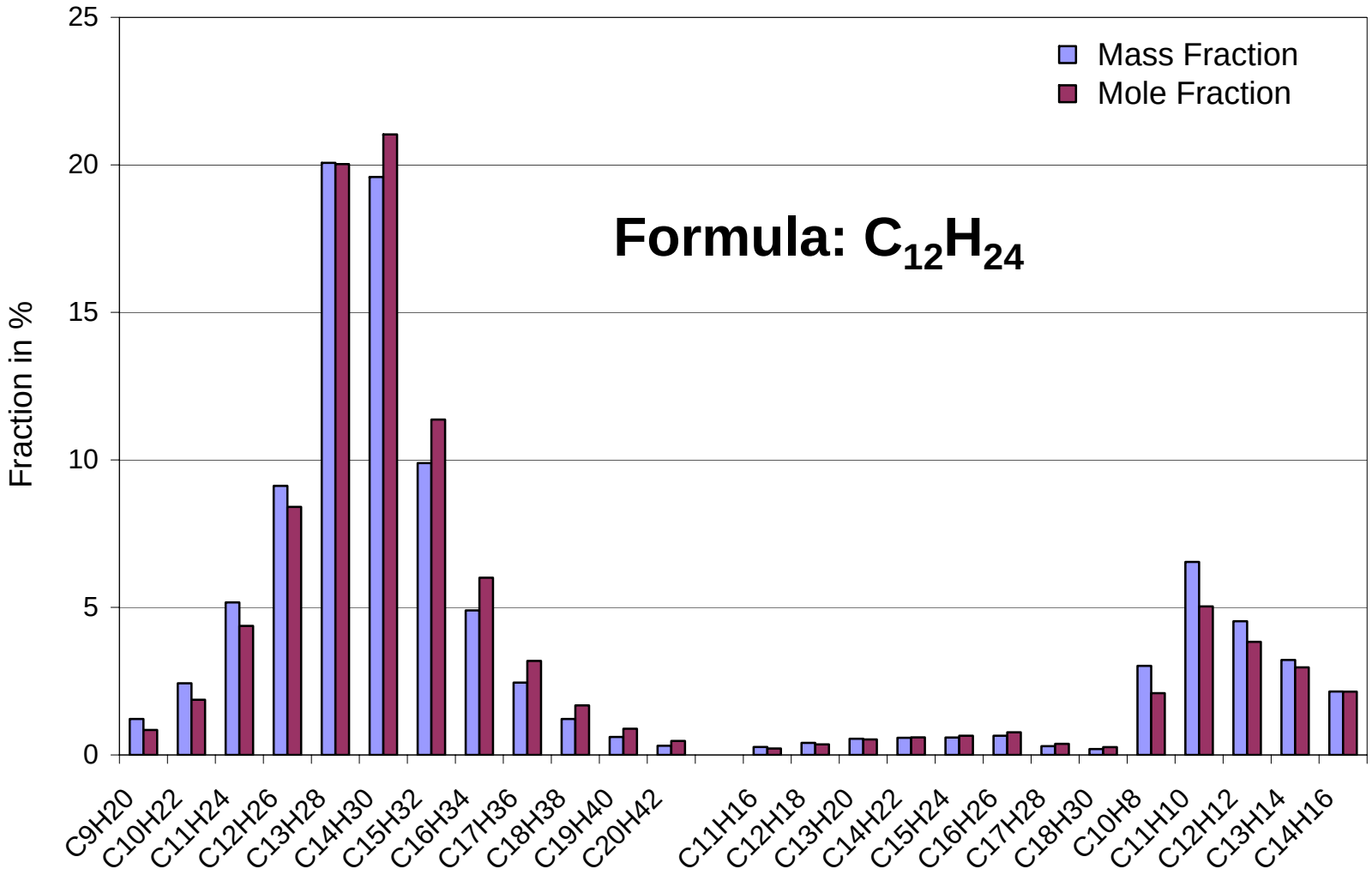
Ausgabe
Eingabe bedingt (über Drop-D
Eingabe

Produkte CPO	Stoffmenge [mol/s]	Bedingung
H2	7,603E-03	entered
H2O	2,828E-03	entered
CO	8,698E-03	entered
CO2	2,385E-03	entered
CH4	2,943E-07	entered
C2H2	1,535E-13	entered
C	0,000E+00	abgelagert
N2	2,452E-02	entered
O2	8,1021E-19	entered
NO	6,4906E-14	entered
CxHy	0,0000E+00	entered
Summe	0,0460	

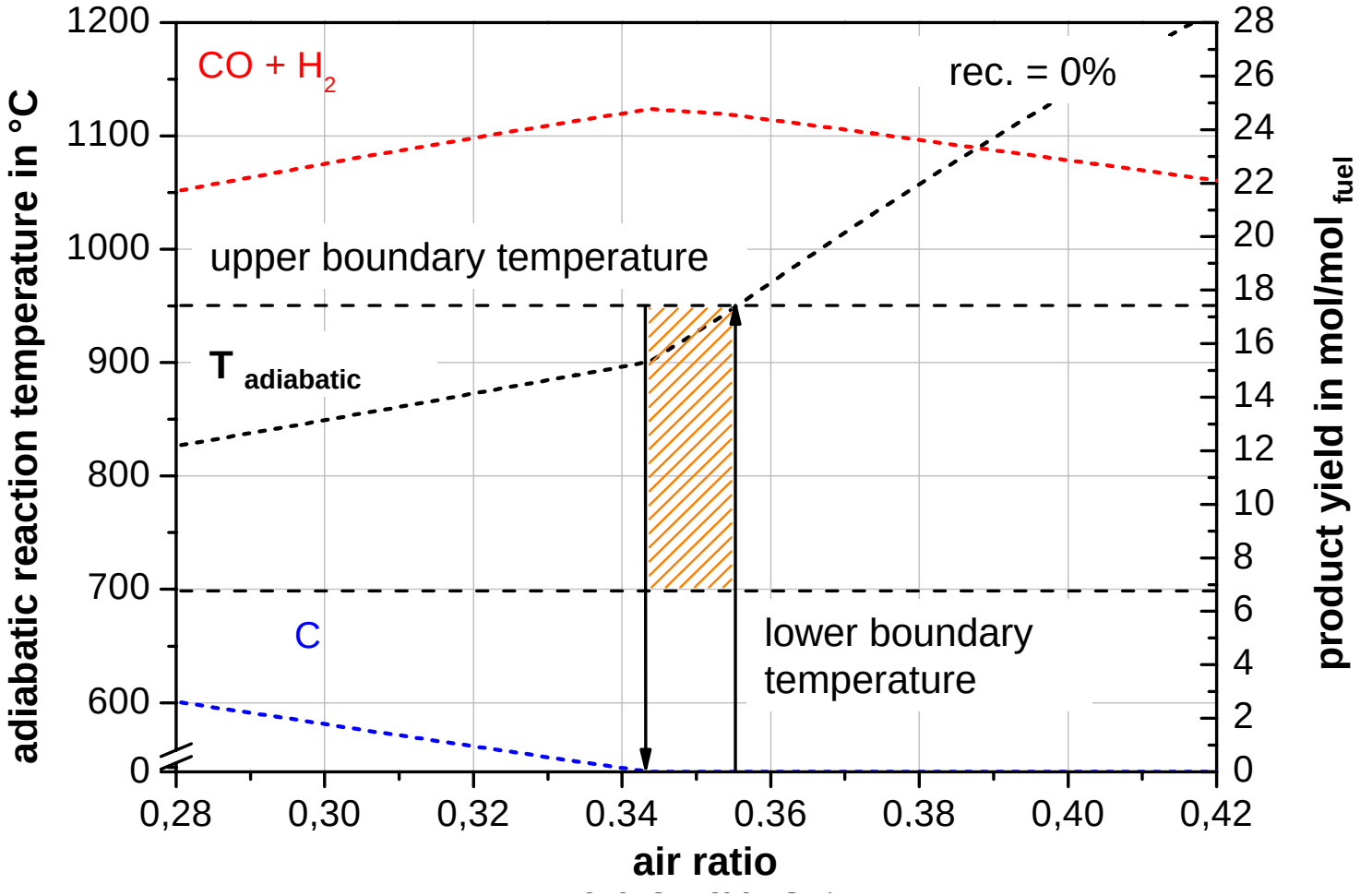
Aktivität
6,394E-06
0,0140957

activity

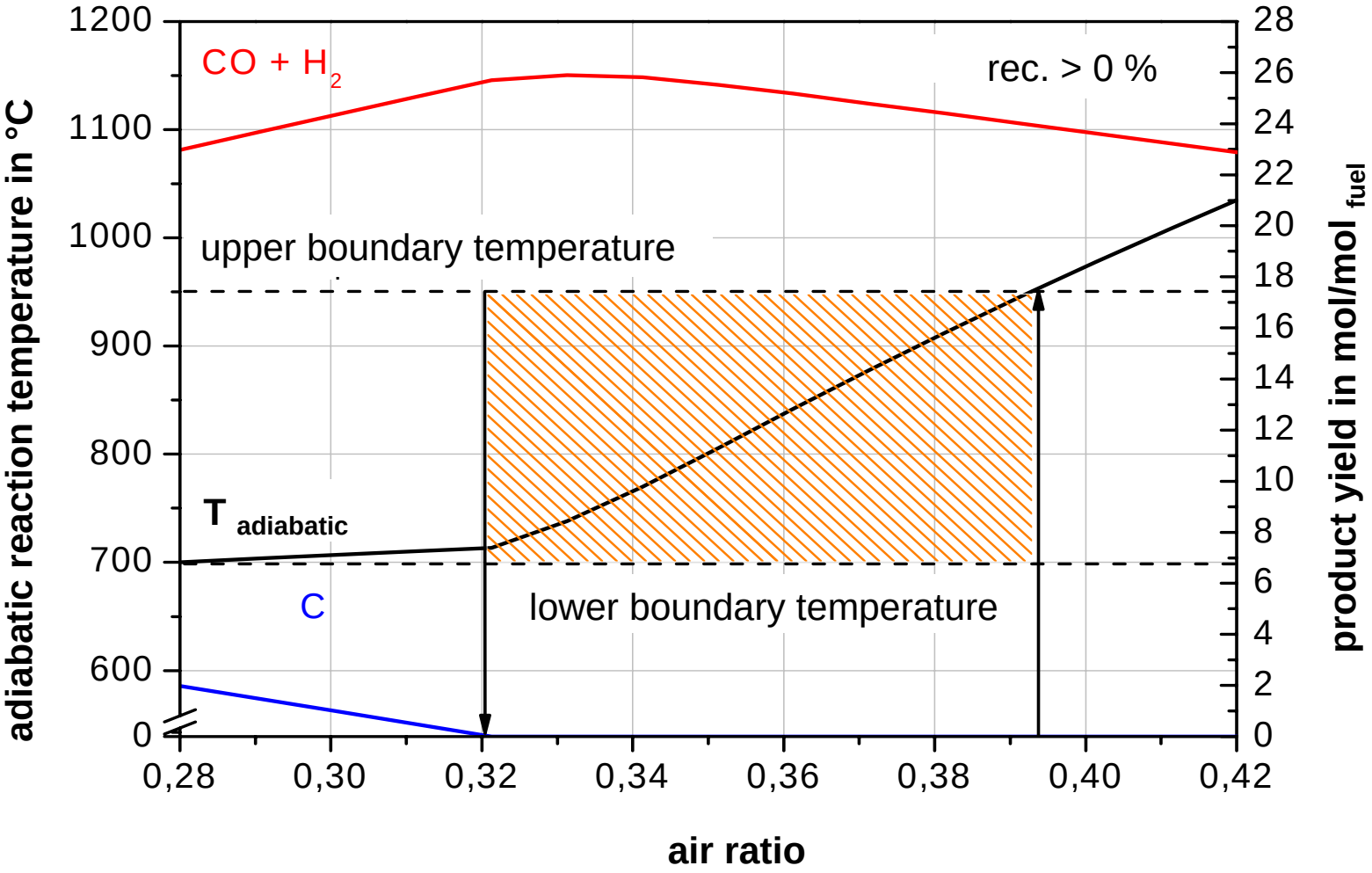
Model Fuel (according to Amphlett) for Material Data Bank



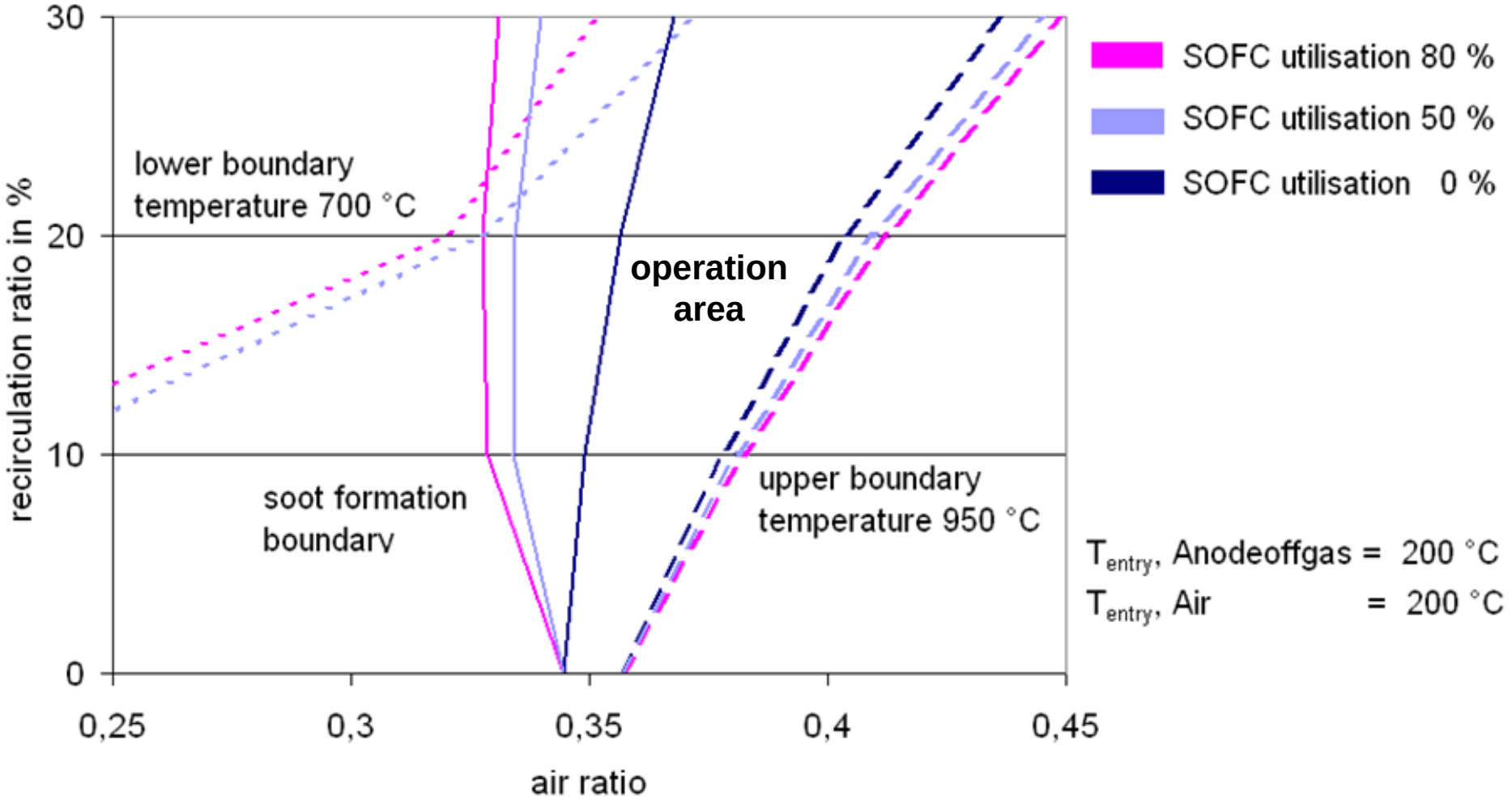
Operation Area of CPO-Process



Operation Area of CPO-Process with Anode-Offgas Recirculation



Operation Area Depending on Recirculation Ratio and SOFC-Utilisation



Conclusion

- catalytic partial oxidation is possible for stationary an mobile applications
- restricted operation area of CPO-process between soot-formation and boundary temperature of catalyst
- the equillibrium calculation based on ChemSheet showes the potential of recirculation of anode-offgas
- increase in the part of recirculated anode-offgas enlarges the operation area of CPO-process