Supporting Information for article

Várhegyi, G.; Czégény, Zs.; Liu, C.; McAdam, K.:

Thermogravimetric analysis of tobacco combustion assuming DAEM devolatilization and empirical char-burnoff kinetics.

Ind. Eng. Chem. Res., **2010**, *49*, 1591-1599. *doi:* 10.1021/ie901180d

Scope of this document: The simultaneous least squares evaluation of 30 samples is shown in computer-generated figures at three model variants:

Figure 1. Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.

Figure 2. Model assumptions: DAEM with constant preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.

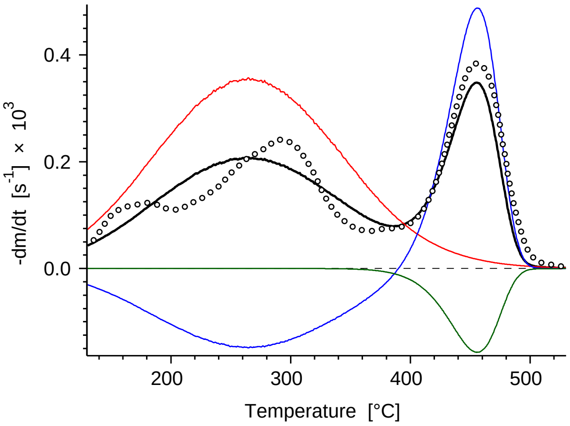
Figure 3. Model assumptions: DAEM with variable preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)

Arrangement. Each figure has six pages. Each page shows the five experiments of a tobacco sample at a given oxygen concentration. (Note that two parallels were used from the 40°C/min experiments due to their low sample mass, as described in the paper.)

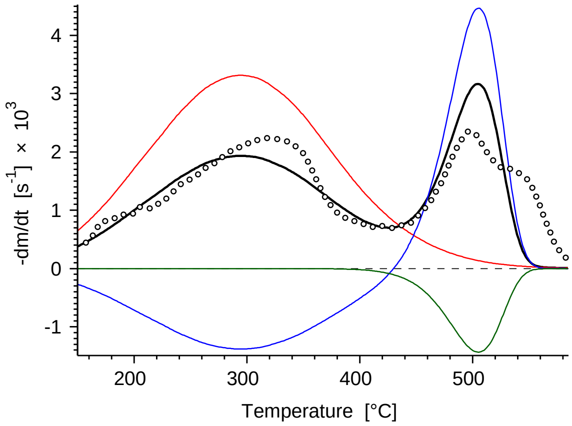
Notation. Experimental DTG curves normalized by the initial sample mass (ooo); their calculated counterpart (black ——); and simulated partial curves $-dm_{ur}/dt$ (red —); $-dm_{char}/dt$ (blue —); and $-dm_{ash}/dt$ (green —). The stepwise temperature programs (+ + +) are also shown when appropriate.

Data below the graphics in the figure panels. The first line beneath the graphics contain the experimental conditions, including the initial sample mass (G_0) and the dimensionless V/V concentration of the oxygen (C_{O_2}). The next line contains the fit_1 and fit_{30} values, as described in the paper. The following lines list the model parameters. (The first line of parameters in red color belongs to the devolatilization, while the second line in blue contains the char burn-off parameters.)

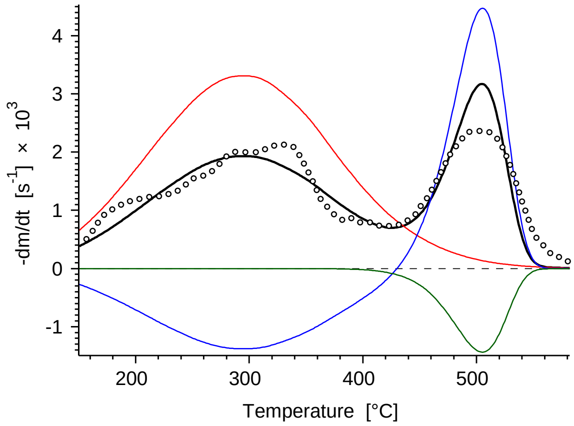
Further information. Please address any question with this document to the corresponding author Email: varhegyi.gabor@t-online.hu or gvarhegyi@gmail.com



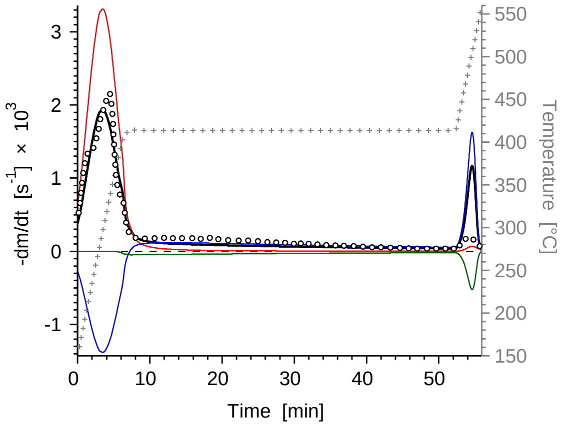
Virginia blend, **G_0=2.0mg C_{O2}=0.02, 4°C/min**
fit$_1$: 8.33%; fit$_{30}$: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317



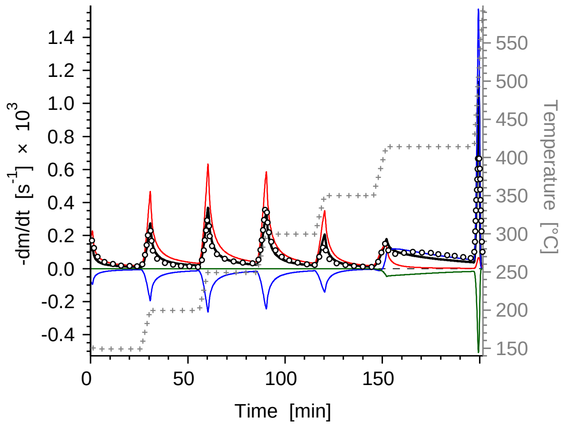
Virginia blend, **G_0=0.4mg C_{O2}=0.02, 40°C/min**
fit$_1$: 18.32%; fit$_{30}$: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317



Virginia blend, **G_0=0.40mg C_{O2}=0.02, 40°C/min**
fit$_1$: 11.61%; fit$_{30}$: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317

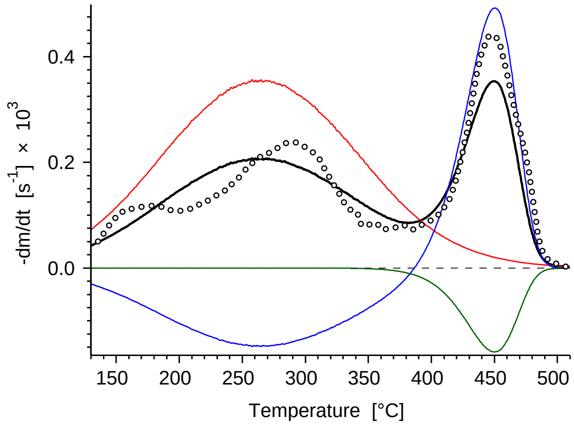


Virginia blend, **G_0=1.00mg C_{O2}=0.02 40°C/min, 45' at 414°C**
fit$_1$: 7.17%; fit$_{30}$: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317

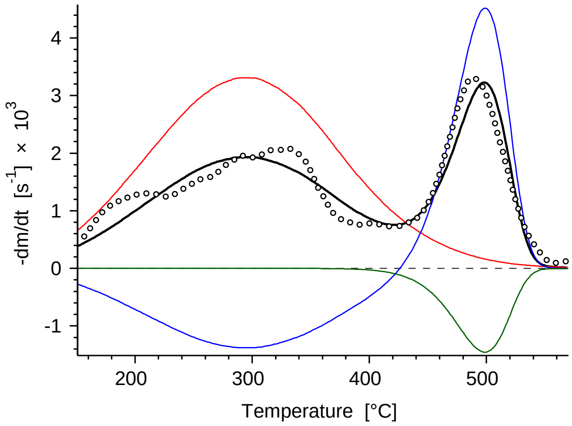


Virginia blend, **G_0=2.1mg C_{O2}=0.02 stepwise T(t)**
fit$_1$: 5.71%; fit$_{30}$: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317

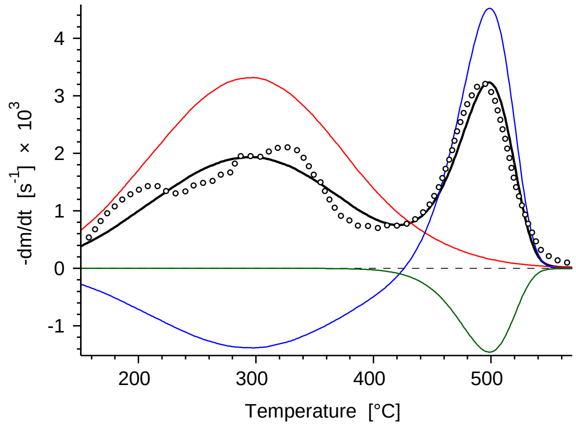
Figure 1/a (Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.)



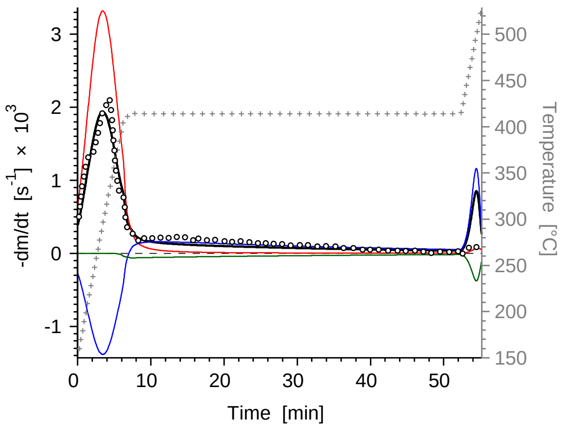
Virginia blend, **G_0=2.0mg C_{O2}=0.04, 4°C/min**
fit_1: 8.68%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317



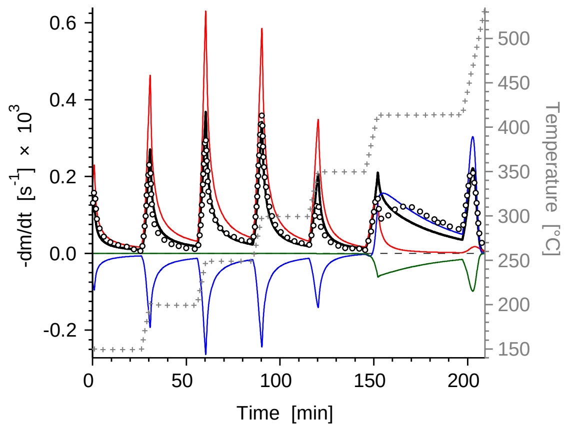
Virginia blend, **G_0=0.4mg C_{O2}=0.04, 40°C/min**
fit_1: 6.80%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317



Virginia blend, **G_0=0.40 mg C_{O2}=0.04, 40°C/min**
fit_1: 6.68%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317

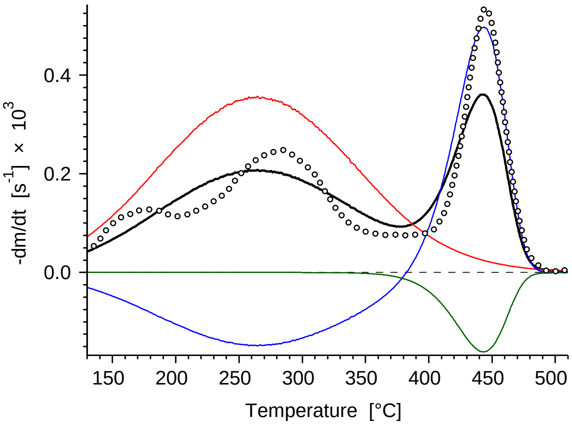


Virginia blend, **G_0=1.1mg C_{O2}=0.04 40°C/min, 45' at 414°C**
fit_1: 6.00%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317

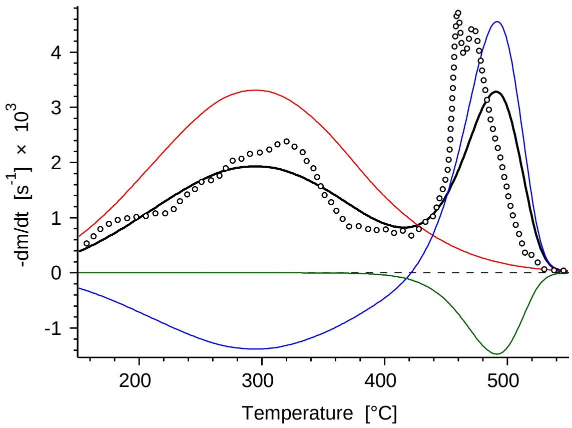


Virginia blend, **G_0=2.0mg C_{O2}=0.04 stepwise T(t)**
fit_1: 6.14%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10}$ A=13.31 ν=0.420 yield=0.317

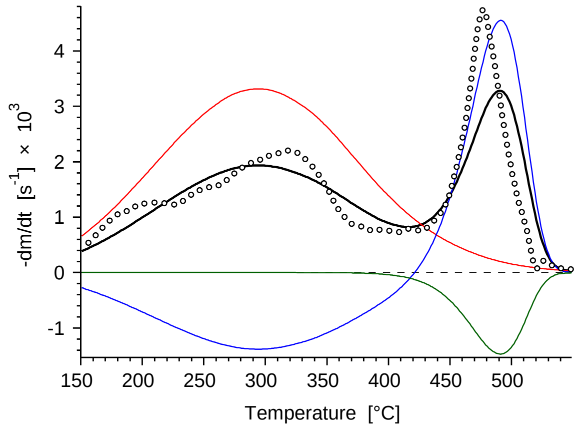
Figure 1/b (Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.)



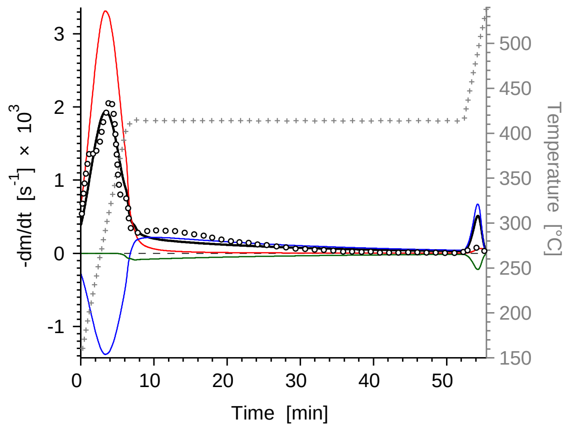
Virginia blend, , G_0=2.1mg C_{O2}=0.09, 4°C/min
fit_1: 9.24%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10} A$=13.31 ν=0.420 yield=0.317



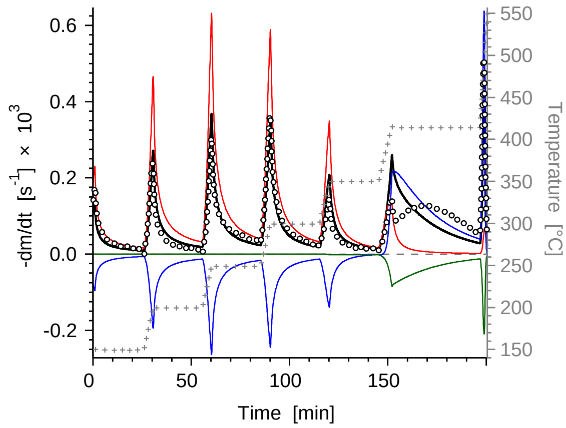
Virginia blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 13.82%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10} A$=13.31 ν=0.420 yield=0.317



Virginia blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 10.36%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10} A$=13.31 ν=0.420 yield=0.317

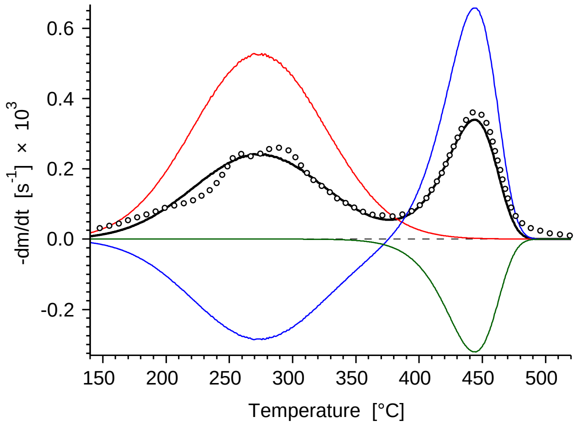


Virginia blend, G_0=1.0mg C_{O2}=0.09 40°C/min, 45' at 414°C
fit_1: 5.37%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10} A$=13.31 ν=0.420 yield=0.317

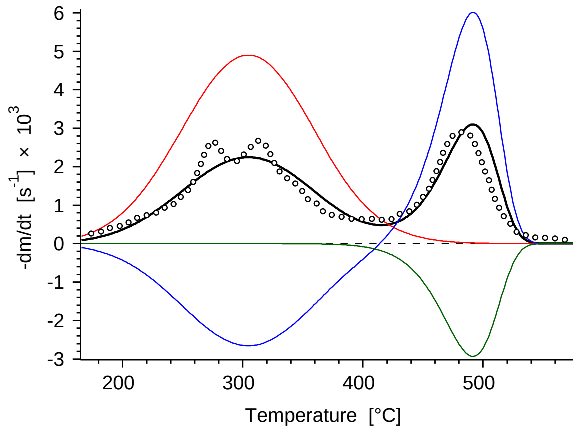


Virginia blend, G_0=2.1mg C_{O2}=0.09, stepwise T(t)
fit_1: 5.83%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.417
2: E= 210.7 $\log_{10} A$=13.31 ν=0.420 yield=0.317

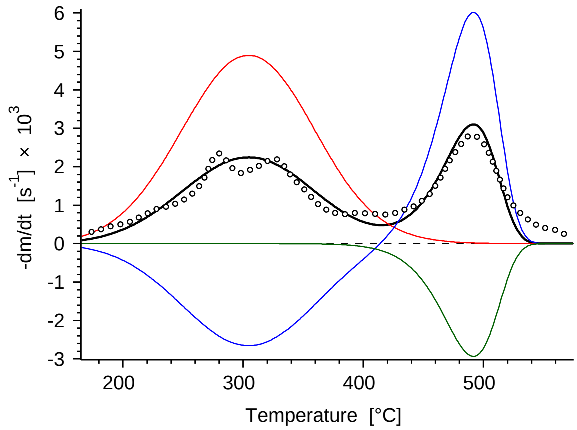
Figure 1/c (Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.)



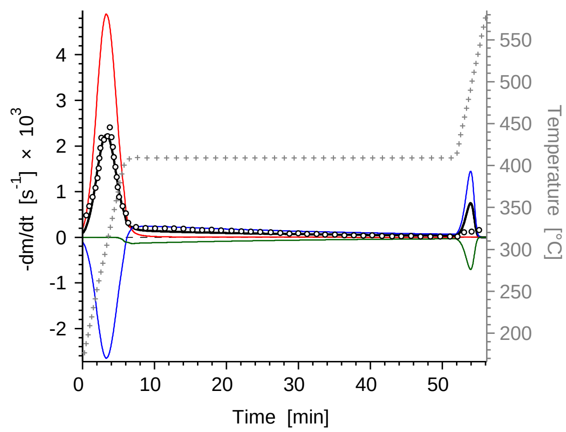
Burley blend, G_0=2.0mg C_{O2}=0.02, 4°C/min
fit_1: 5.31%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487



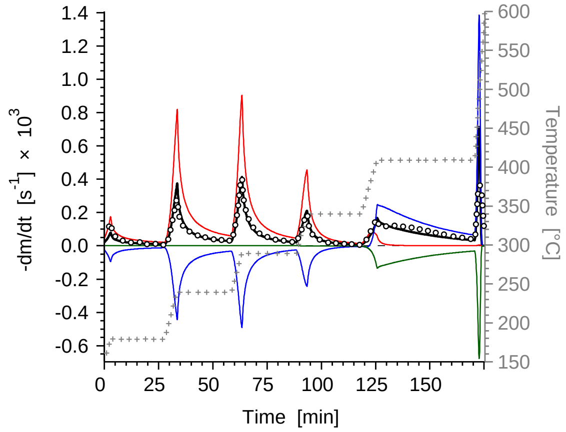
Burley blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 9.89%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487



Burley blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 8.51%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

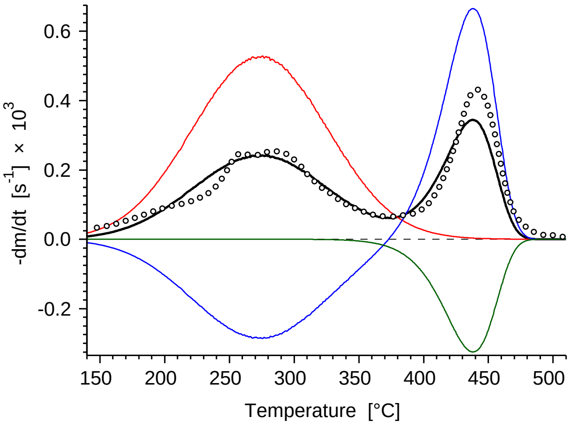


Burley blend, G_0=1.0mg C_{O2}=0.02 40°C/min, 45' at 409°C
fit_1: 4.16%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

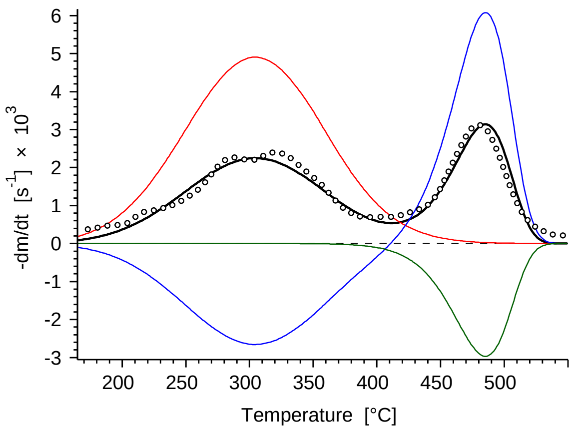


Burley blend, G_0=2.0mg C_{O2}=0.02 stepwise T(t)
fit_1: 8.76%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

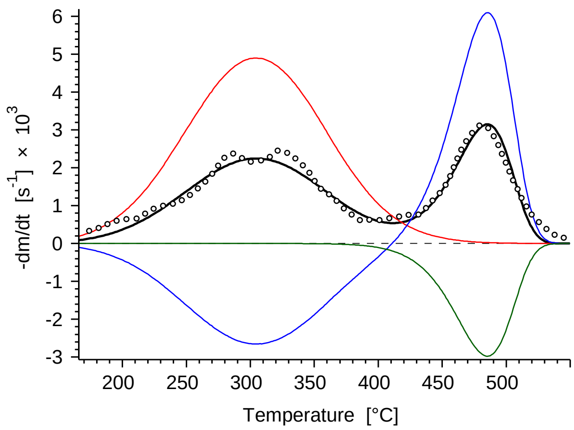
Figure 1/d (Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.)



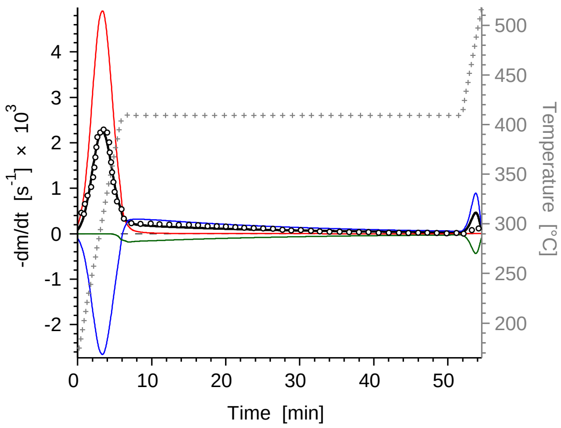
Burley blend, G_0=2.1mg C_{O2}=0.04, 4°C/min
fit_1: 7.57%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 $\sigma(E)$=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487



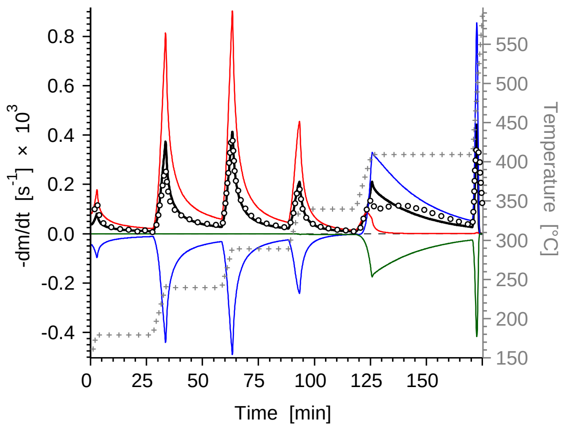
Burley blend, G_0=0.4mg (2.027mg) C_{O2}=0.04, 40°C/min
fit_1: 5.77%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 $\sigma(E)$=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487



Burley blend, G_0=0.4mg C_{O2}=0.04, 40°C/min
fit_1: 5.72%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 $\sigma(E)$=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

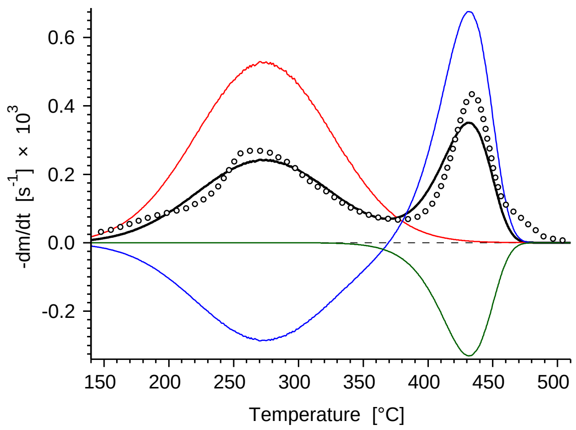


Burley blend, G_0=1.0mg C_{O2}=0.04 40°C/min, 45' at 409°C
fit_1: 3.21%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 $\sigma(E)$=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

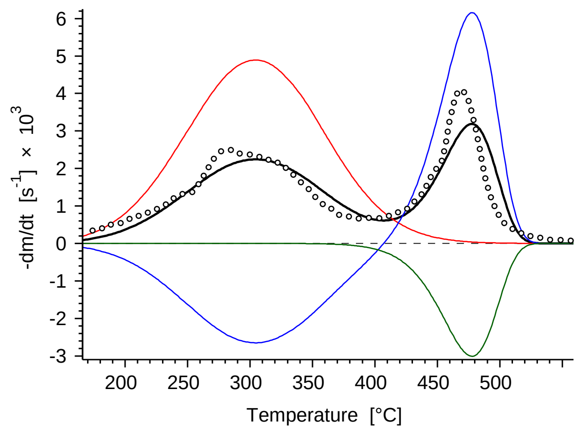


Burley blend, G_0=2.0mg C_{O2}=0.04 stepwise T(t)
fit_1: 8.34%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 $\sigma(E)$=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

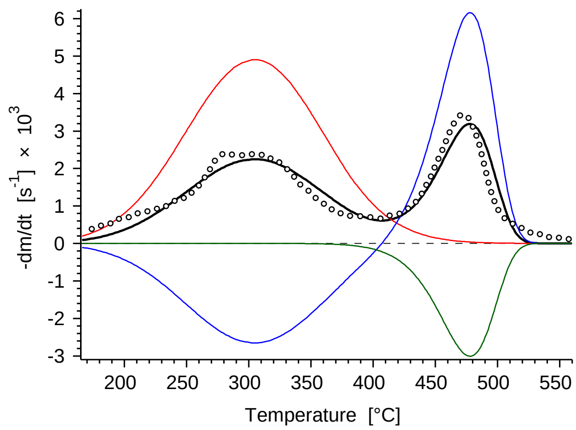
Figure 1/e (Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.)



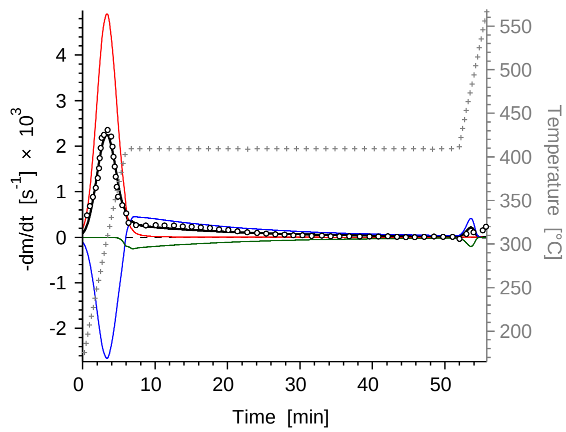
Burley blend, , G_0=2.0mg C_{O2}=0.09, 4°C/min
fit_1: 7.59%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487



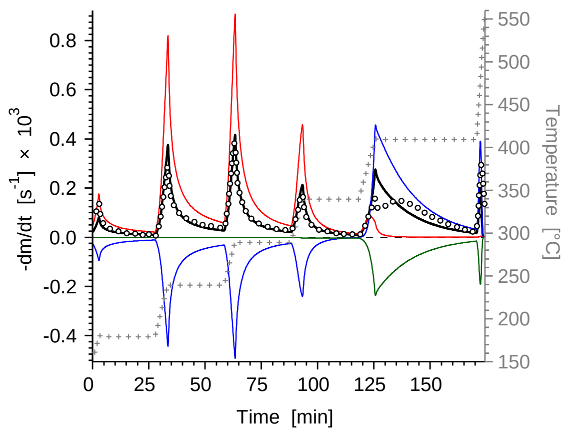
Burley blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 8.72%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487



Burley blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 7.20%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

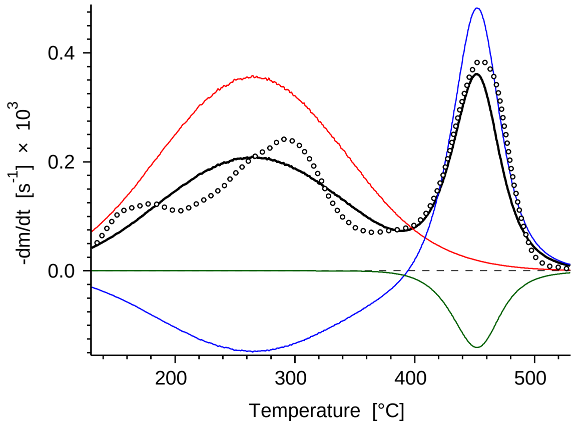


Burley blend, G_0=1.0mg, C_{O2}=0.09 40°C/min, 45' at 409°C
fit_1: 2.83%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

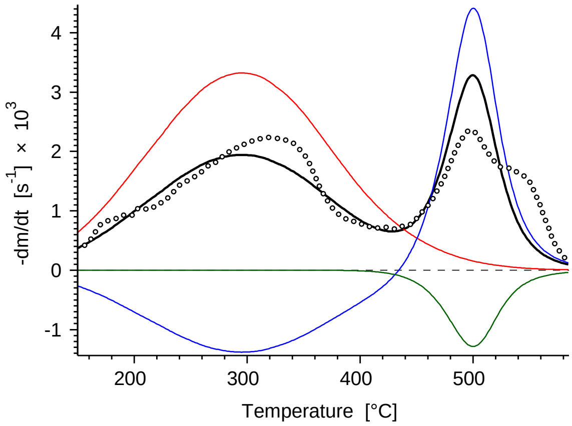


Burley blend, G_0=2.0mg C_{O2}=0.09, stepwise T(t)
fit_1: 8.41%; fit_{30}: 7.79%
1: E_0=185.6 $\log_{10} A_0$=15.18 σ(E)=17.2 yield=0.542
2: E= 210.7 $\log_{10}$ A=13.57 ν=0.420 yield=0.487

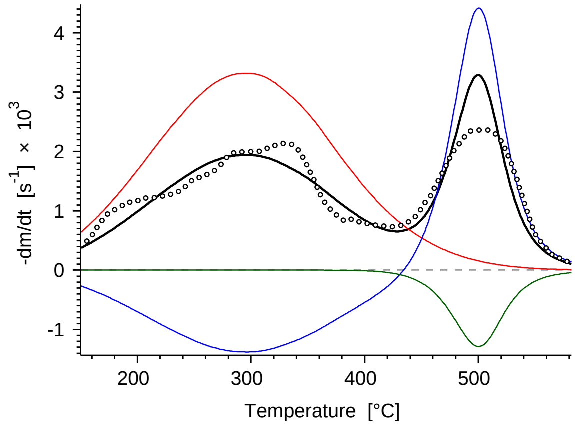
Figure 1/f (Model assumptions: DAEM with constant preexponential factor and first order char burn-off kinetics with respect to m_{char}.)



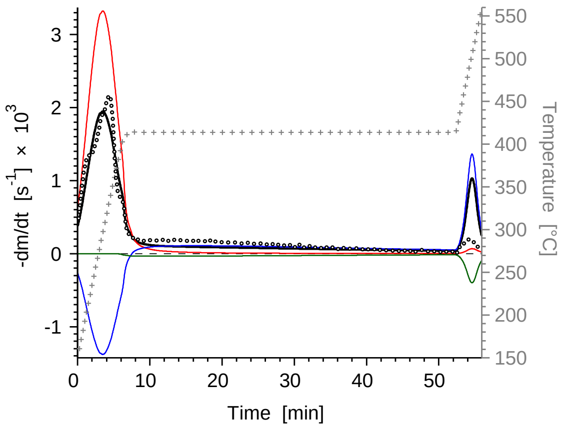
Virginia blend, G_0=2.0mg C_{O2}=0.02, 4°C/min
fit$_1$: 8.57%; fit$_{30}$: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287



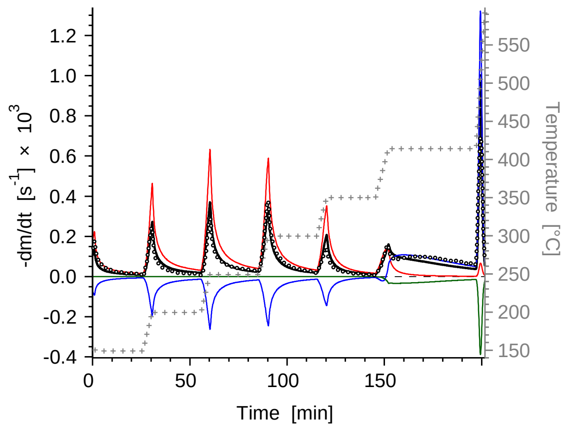
Virginia blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit$_1$: 16.03%; fit$_{30}$: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287



Virginia blend, G_0=0.40mg C_{O2}=0.02, 40°C/min
fit$_1$: 11.31%; fit$_{30}$: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

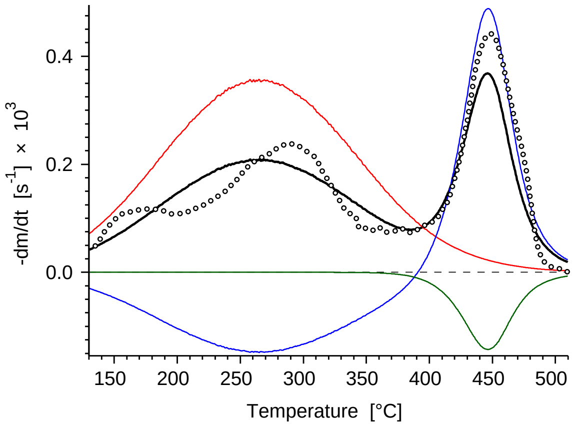


Virginia blend, G_0=1.00mg C_{O2}=0.02 40°C/min, 45' at 414°C
fit$_1$: 6.97%; fit$_{30}$: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

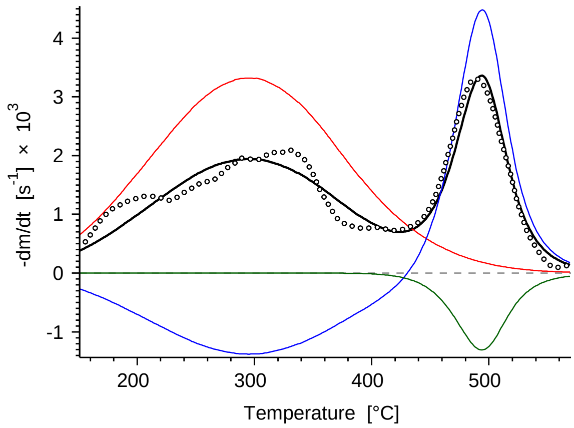


Virginia blend, G_0=2.1mg C_{O2}=0.02 stepwise T(t)
fit$_1$: 3.96%; fit$_{30}$: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

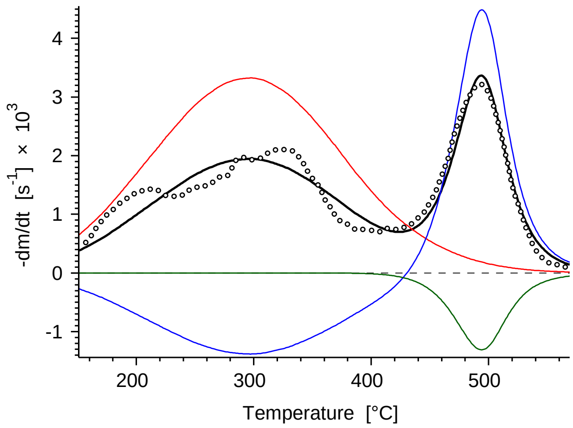
Figure 2/a (Model assumptions: DAEM with constant preexponential factor and an empirical f(α,m_{char}) function in the char burn-off kinetics.)



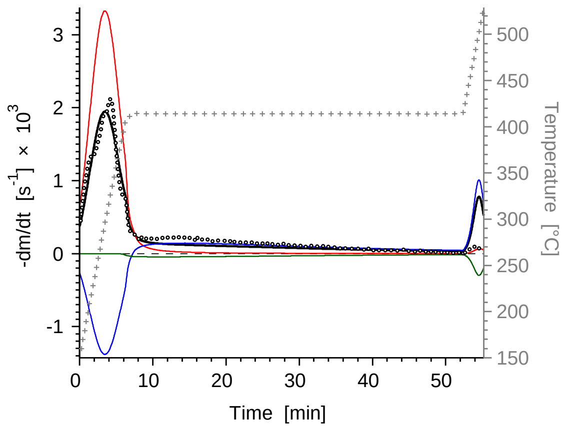
Virginia blend, G_0=2.0mg C_{O2}=0.04, 4°C/min
fit_1: 8.62%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287



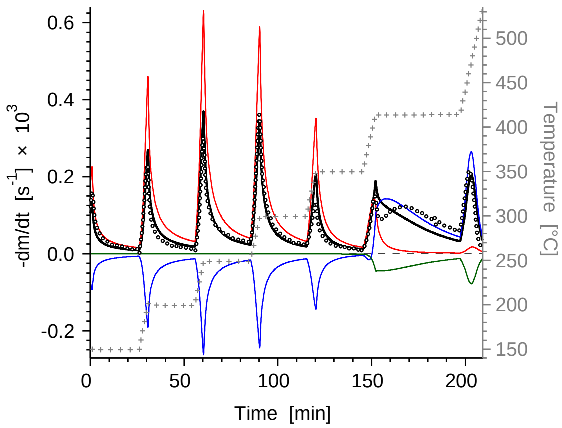
Virginia blend, G_0=0.4mg C_{O2}=0.04, 40°C/min
fit_1: 5.90%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287



Virginia blend, G_0=0.40 mg C_{O2}=0.04, 40°C/min
fit_1: 6.18%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

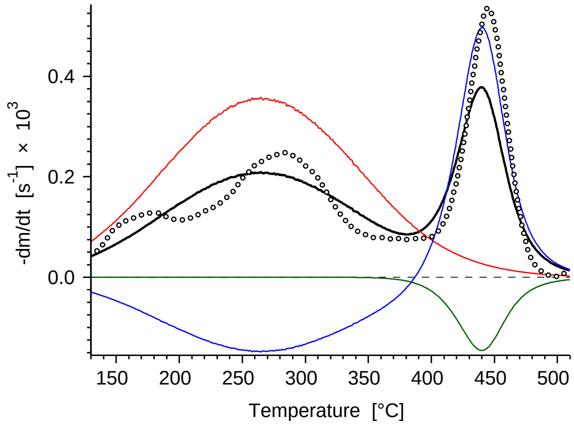


Virginia blend, G_0=1.1mg C_{O2}=0.04 40°C/min, 45' at 414°C
fit_1: 5.88%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

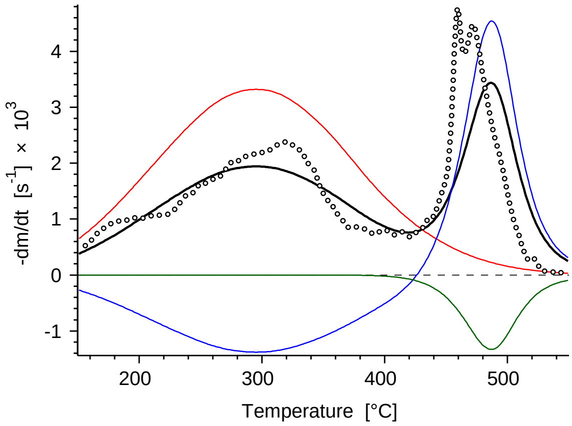


Virginia blend, G_0=2.0mg C_{O2}=0.04 stepwise T(t)
fit_1: 6.13%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

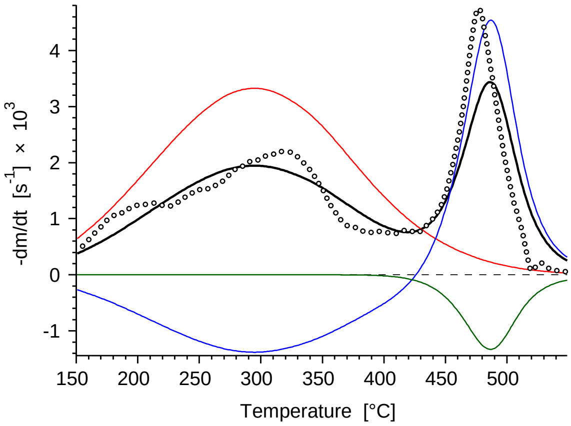
Figure 2/b (Model assumptions: DAEM with constant preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)



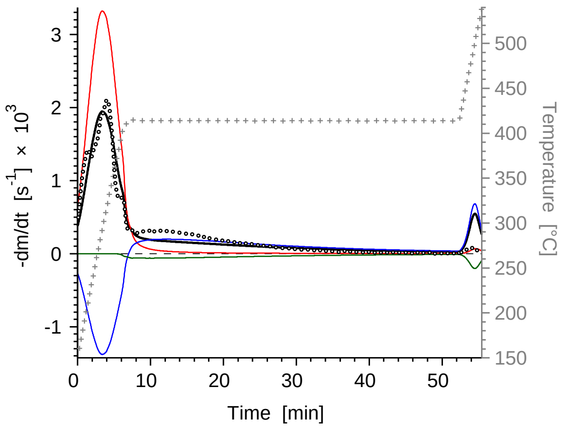
Virginia blend, G_0=2.1mg C_{O2}=0.09, 4°C/min
fit_1: 9.36%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$ A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287



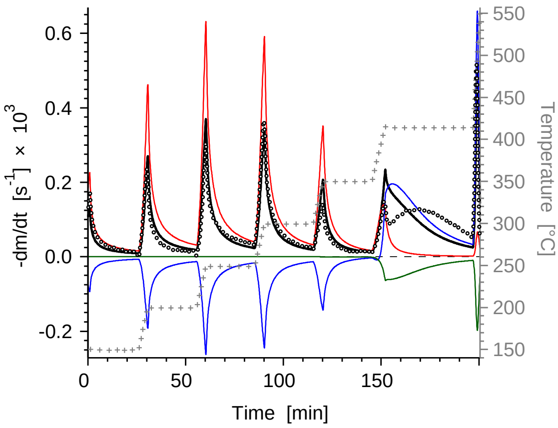
Virginia blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 13.22%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$ A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287



Virginia blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 9.33%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$ A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

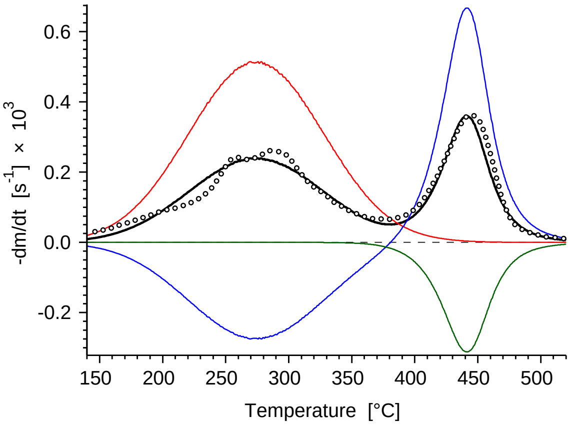


Virginia blend, G_0=1.0mg C_{O2}=0.09 40°C/min, 45' at 414°C
fit_1: 5.69%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$ A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

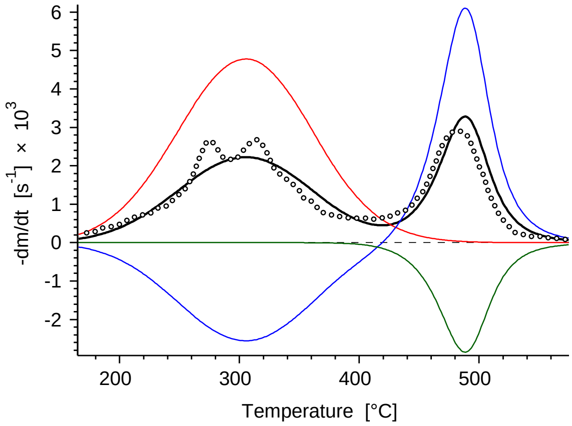


Virginia blend, G_0=2.1mg C_{O2}=0.09, stepwise T(t)
fit_1: 6.14%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.43 σ(E)=26.7 yield=0.415
2: E= 212.6 $\log_{10}$ A=14.38 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.287

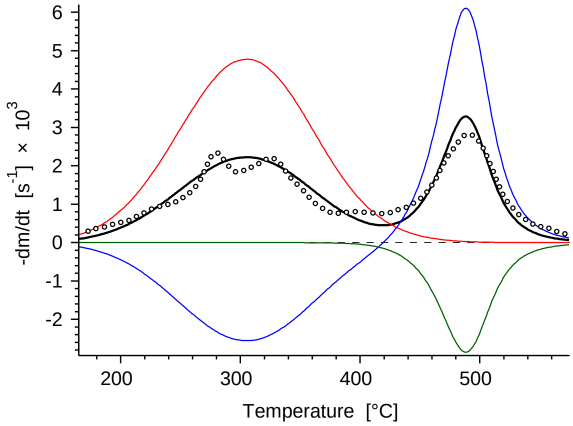
Figure 2/c (Model assumptions: DAEM with constant preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)



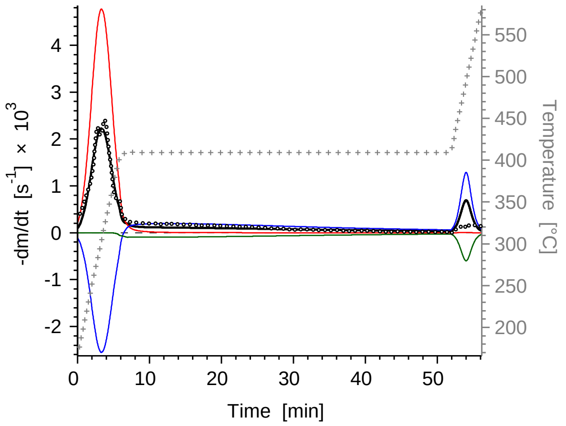
Burley blend, G_0=2.0mg C_{O2}=0.02, 4°C/min
fit_1: 5.42%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466



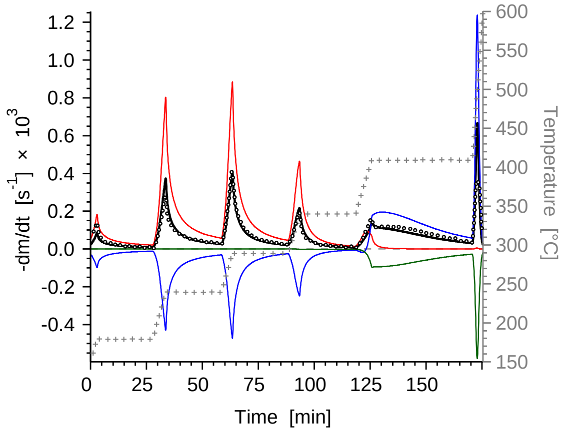
Burley blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 9.68%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466



Burley blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 7.90%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

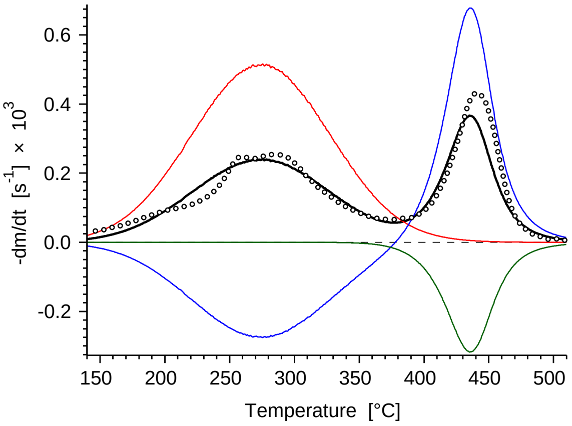


Burley blend, G_0=1.0mg C_{O2}=0.02 40°C/min, 45' at 409°C
fit_1: 4.11%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

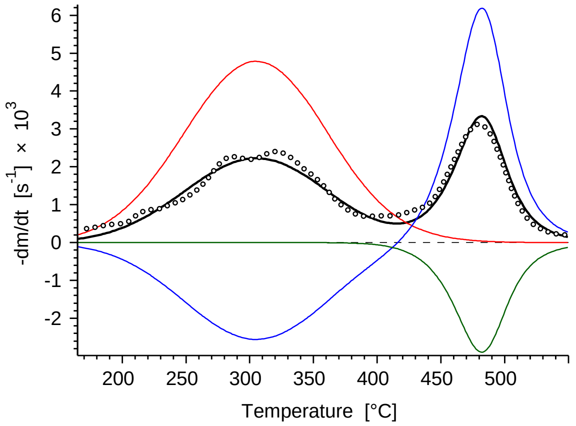


Burley blend, G_0=2.0mg C_{O2}=0.02 stepwise T(t)
fit_1: 6.78%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

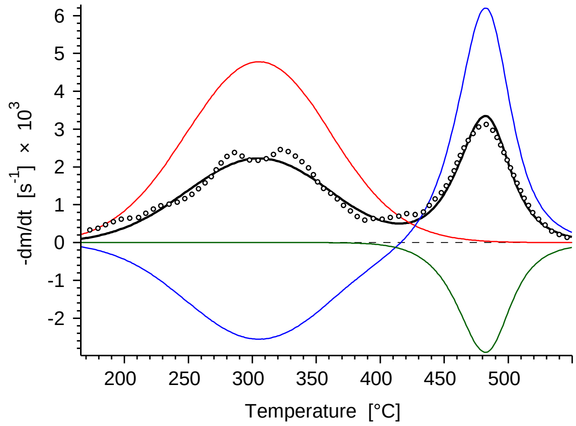
Figure 2/d (Model assumptions: DAEM with constant preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)



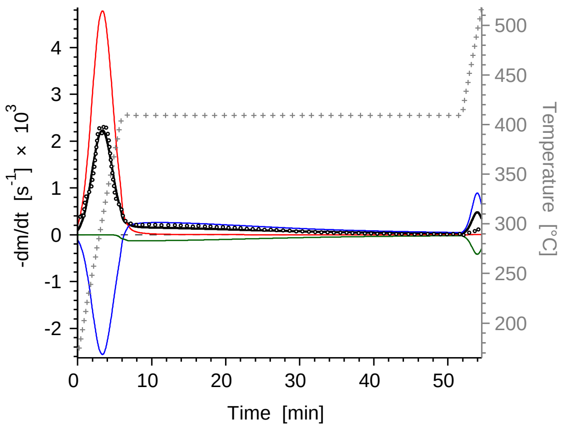
Burley blend, G_0=2.1mg C_{O2}=0.04, 4°C/min
fit_1: 7.57%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466



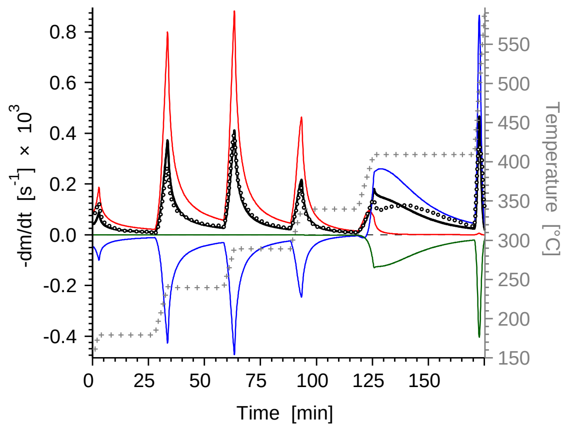
Burley blend, G_0=0.4mg (2.027mg) C_{O2}=0.04, 40°C/min
fit_1: 5.16%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466



Burley blend, G_0=0.4mg C_{O2}=0.04, 40°C/min
fit_1: 5.09%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

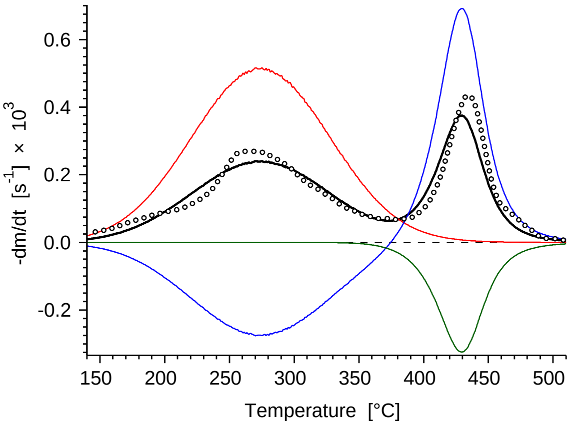


Burley blend, G_0=1.0mg C_{O2}=0.04 40°C/min, 45' at 409°C
fit_1: 3.41%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

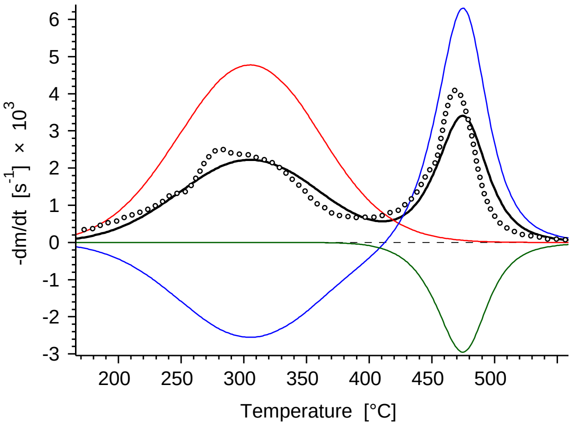


Burley blend, G_0=2.0mg C_{O2}=0.04 stepwise T(t)
fit_1: 5.94%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 σ(E)=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

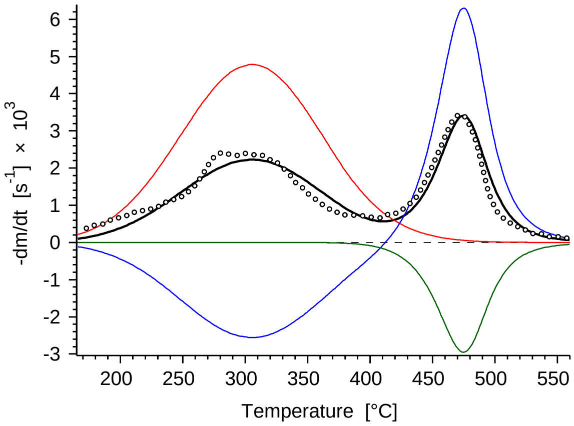
Figure 2/e (Model assumptions: DAEM with constant preexponential factor and an empirical $f(\alpha,m_{char})$ function in the char burn-off kinetics.)



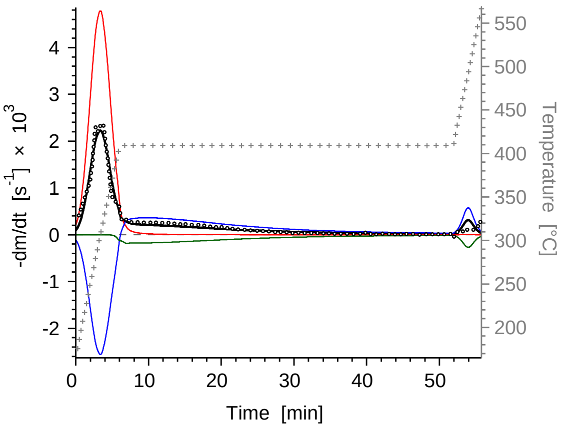
Burley blend, , G_0=2.0mg C_{O2}=0.09, 4°C/min
fit_1: 6.78%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 $\sigma(E)$=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466



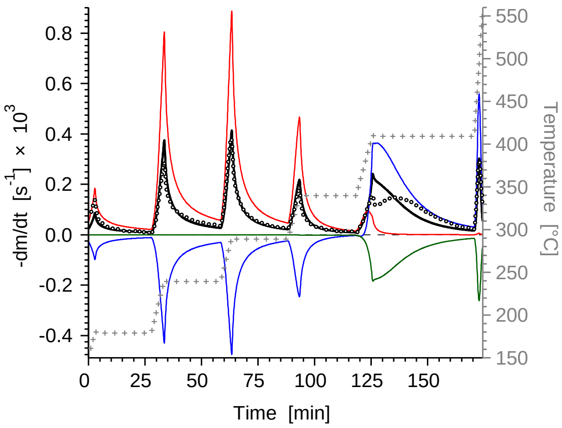
Burley blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 7.78%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 $\sigma(E)$=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466



Burley blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 6.26%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 $\sigma(E)$=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

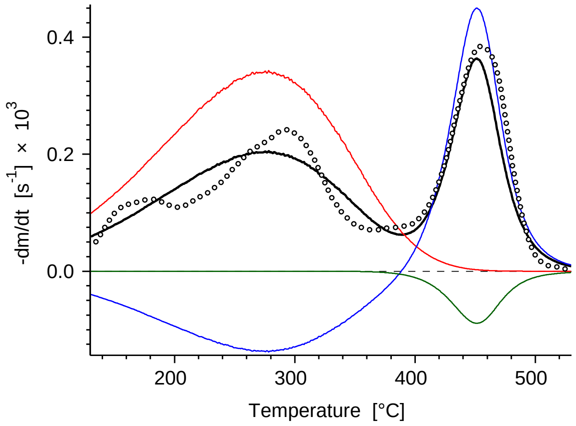


Burley blend, G_0=1.0mg, C_{O2}=0.09 40°C/min, 45' at 409°C
fit_1: 2.90%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 $\sigma(E)$=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

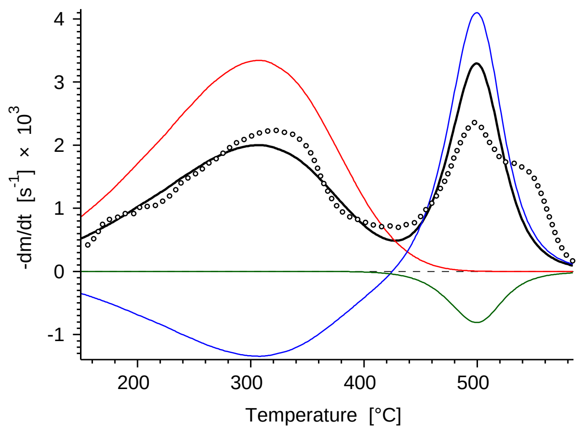


Burley blend, G_0=2.0mg C_{O2}=0.09, stepwise T(t)
fit_1: 6.39%; fit_{30}: 7.21%
1: E_0=185.7 $\log_{10} A_0$=15.17 $\sigma(E)$=17.7 yield=0.535
2: E= 212.6 $\log_{10}$ A=14.54 n=1.96 a=3.42 z=0.010
ν=0.427 yield=0.466

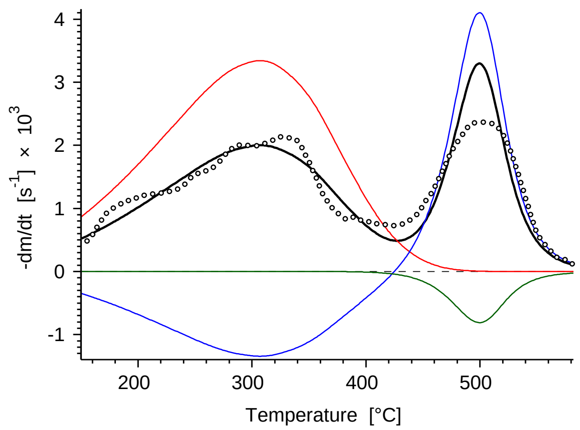
Figure 2/f (Model assumptions: DAEM with constant preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)



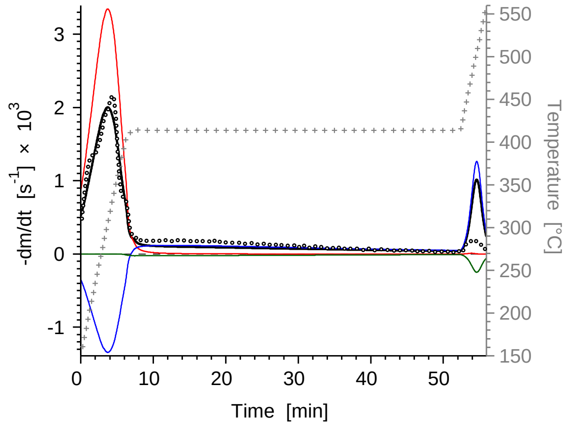
Virginia blend, G_0=2.0mg C_{O2}=0.02, 4°C/min
fit_1: 7.79%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10} A$=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197



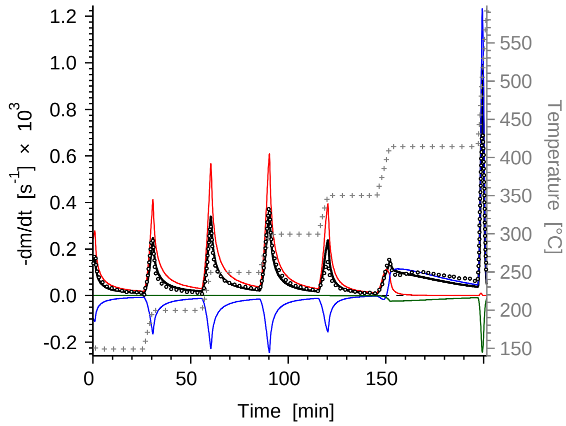
Virginia blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 15.67%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10} A$=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197



Virginia blend, G_0=0.40mg C_{O2}=0.02, 40°C/min
fit_1: 11.15%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10} A$=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

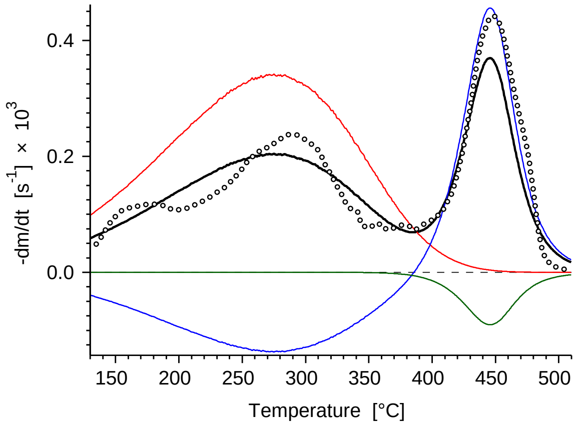


Virginia blend, G_0=1.00mg C_{O2}=0.02 40°C/min, 45' at 414°C
fit_1: 6.57%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10} A$=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

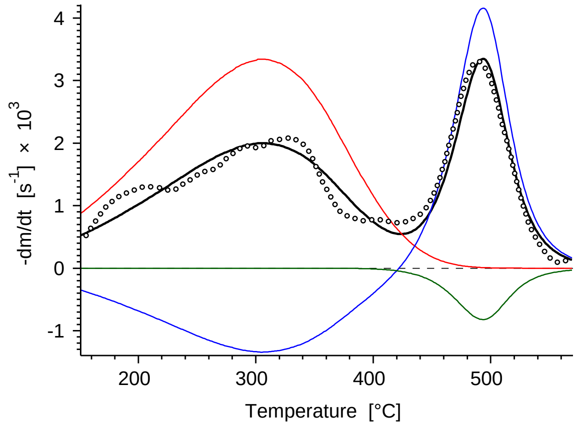


Virginia blend, G_0=2.1mg C_{O2}=0.02 stepwise T(t)
fit_1: 3.78%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10} A$=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

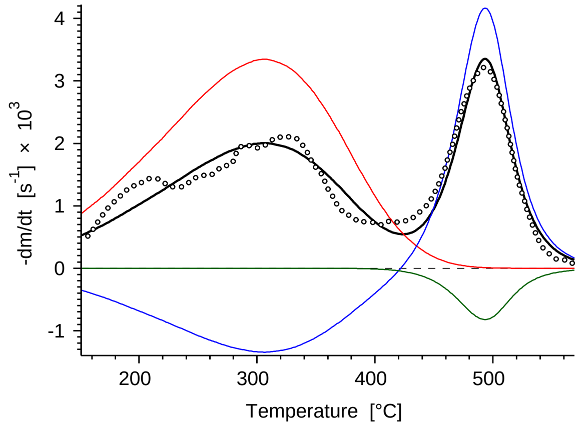
Figure 3/a (Model assumptions: DAEM with variable preexponential factor and an empirical $f(\alpha,m_{char})$ function in the char burn-off kinetics.)



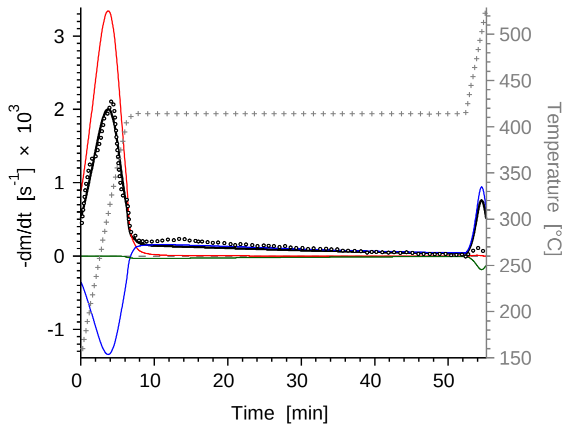
Virginia blend, G_0=2.0mg C_{O2}=0.04, 4°C/min
fit_1: 8.06%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197



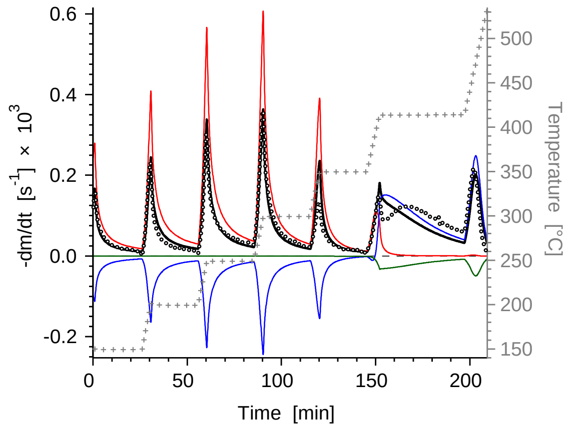
Virginia blend, G_0=0.4mg C_{O2}=0.04, 40°C/min
fit_1: 5.25%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197



Virginia blend, G_0=0.40 mg C_{O2}=0.04, 40°C/min
fit_1: 5.63%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

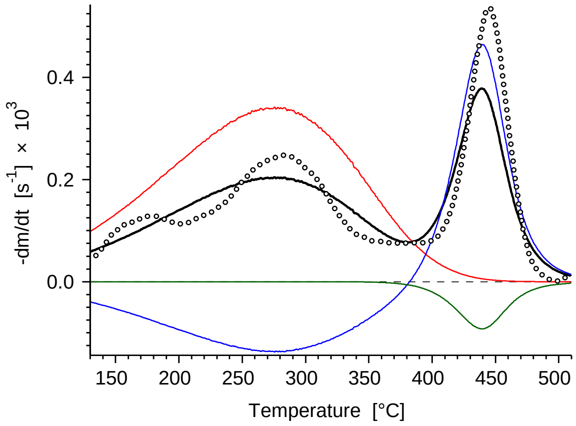


Virginia blend, G_0=1.1mg C_{O2}=0.04 40°C/min, 45' at 414°C
fit_1: 5.49%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

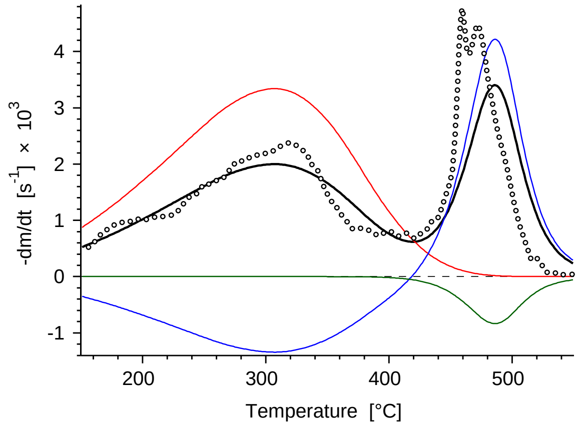


Virginia blend, G_0=2.0mg C_{O2}=0.04 stepwise T(t)
fit_1: 5.93%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

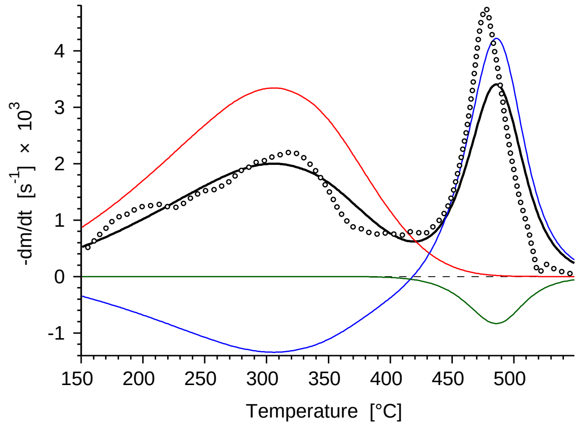
Figure 3/b (Model assumptions: DAEM with variable preexponential factor and an empirical f(α,m_{char}) function in the char burn-off kinetics.)



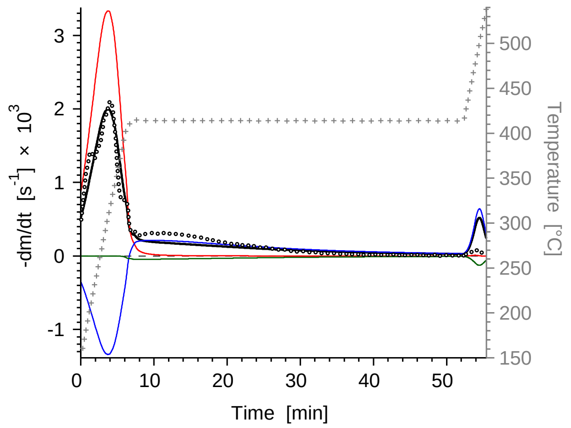
Virginia blend, , G_0=2.1mg C_{O2}=0.09, 4°C/min
fit_1: 9.20%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197



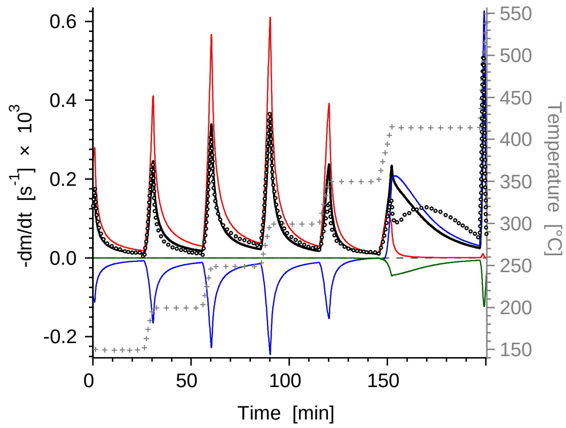
Virginia blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 12.90%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197



Virginia blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 8.98%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

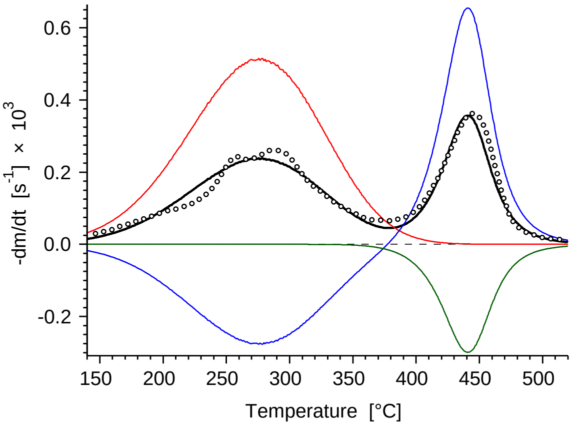


Virginia blend, G_0=1.0mg C_{O2}=0.09 40°C/min, 45' at 414°C
fit_1: 5.25%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

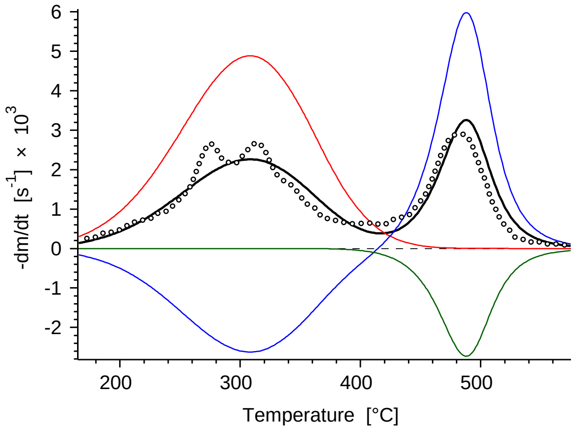


Virginia blend, G_0=2.1mg C_{O2}=0.09, stepwise T(t)
fit_1: 6.02%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=15.37 σ(E)=52.8 yield=0.402 beta=0.106
2: E= 212.4 $\log_{10}$ A=14.32 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.197

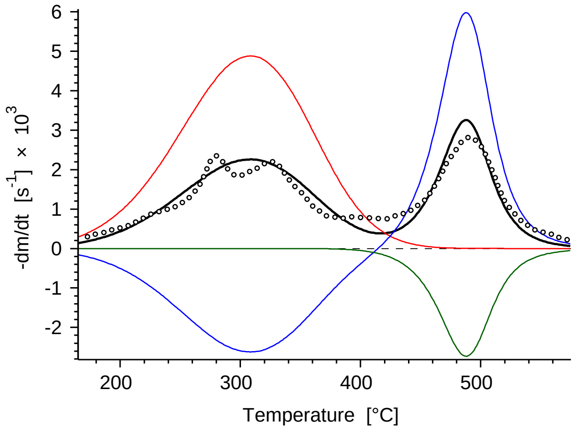
Figure 3/c (Model assumptions: DAEM with variable preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)



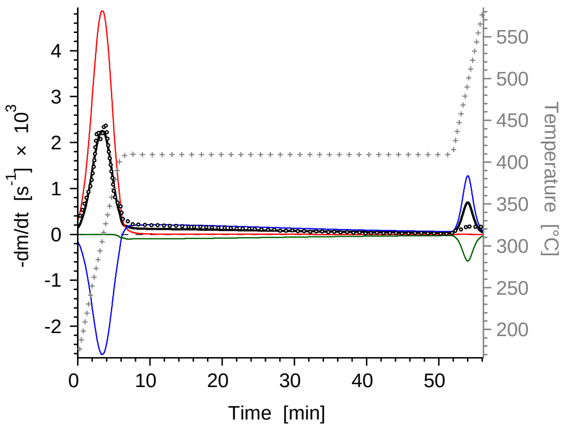
Burley blend, G_0=2.0mg C_{O2}=0.02, 4°C/min
fit_1: 5.31%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



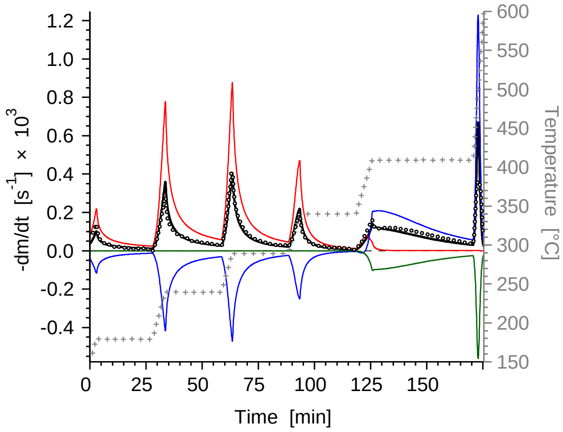
Burley blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 9.69%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



Burley blend, G_0=0.4mg C_{O2}=0.02, 40°C/min
fit_1: 8.16%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

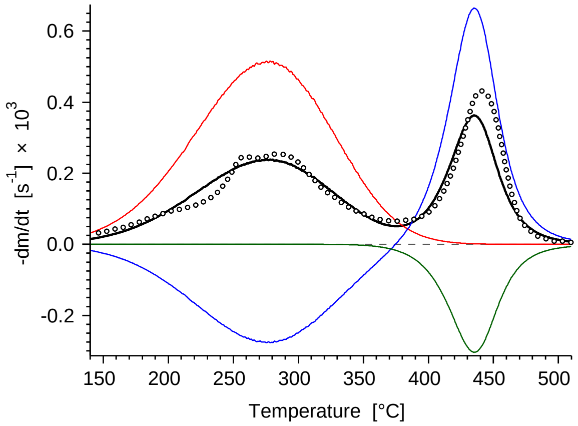


Burley blend, G_0=1.0mg C_{O2}=0.02 40°C/min, 45' at 409°C
fit_1: 4.03%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

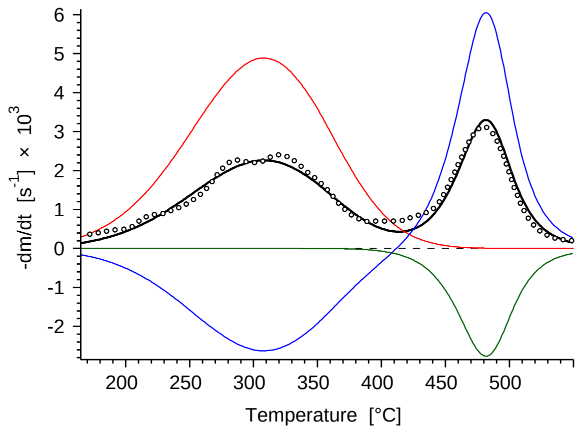


Burley blend, G_0=2.0mg C_{O2}=0.02 stepwise T(t)
fit_1: 6.60%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

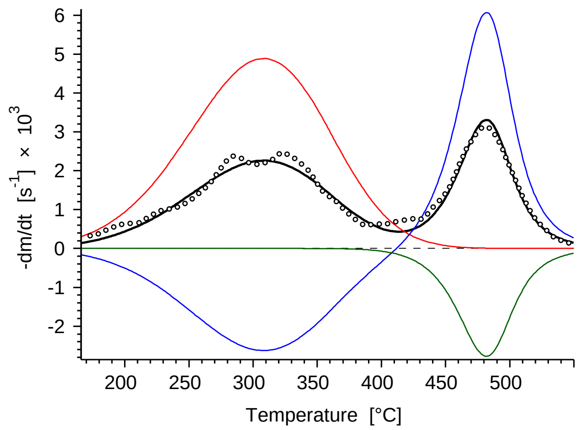
Figure 3/d (Model assumptions: DAEM with variable preexponential factor and an empirical f(α,m_{char}) function in the char burn-off kinetics.)



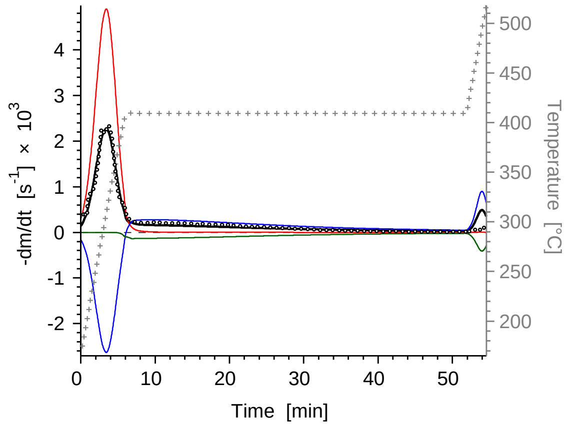
Burley blend, G_0=2.1mg C_{O2}=0.04, 4°C/min
fit$_1$: 7.57%; fit$_{30}$: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$ A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



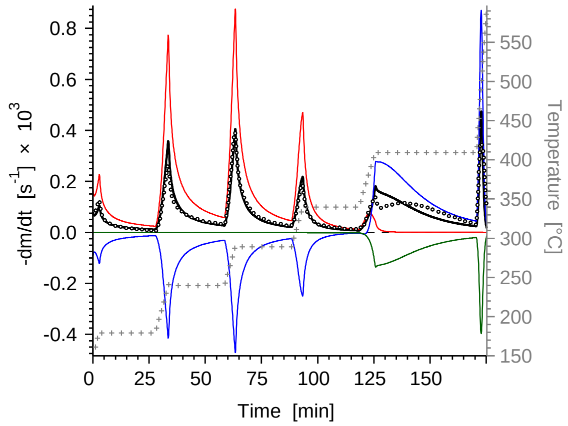
Burley blend, G_0=0.4mg (2.027mg) C_{O2}=0.04, 40°C/min
fit$_1$: 4.90%; fit$_{30}$: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$ A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



Burley blend, G_0=0.4mg C_{O2}=0.04, 40°C/min
fit$_1$: 4.63%; fit$_{30}$: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$ A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

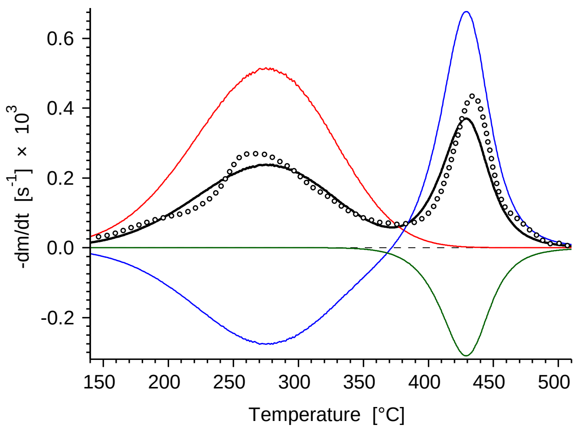


Burley blend, G_0=1.0mg C_{O2}=0.04 40°C/min, 45' at 409°C
fit$_1$: 3.27%; fit$_{30}$: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$ A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

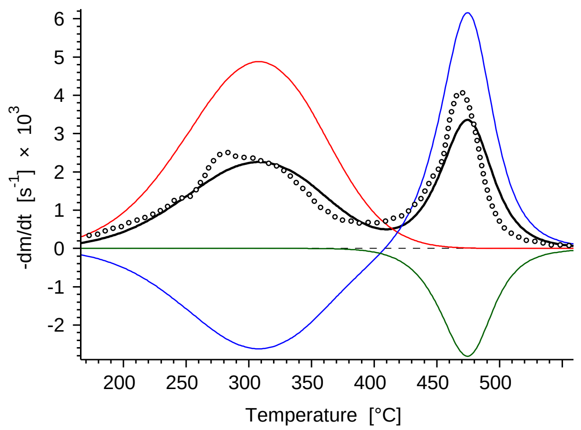


Burley blend, G_0=2.0mg C_{O2}=0.04 stepwise T(t)
fit$_1$: 5.82%; fit$_{30}$: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 σ(E)=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10}$ A=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

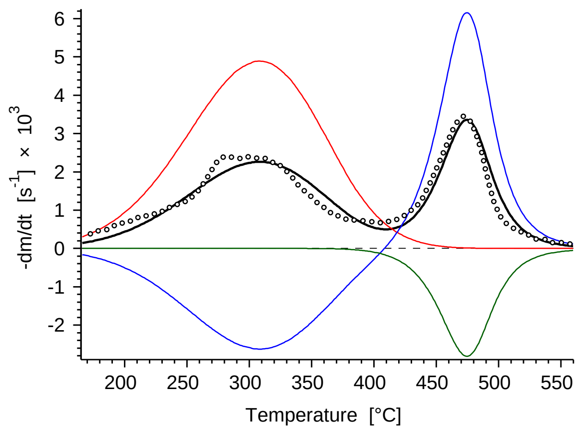
Figure 3/e (Model assumptions: DAEM with variable preexponential factor and an empirical f(α,m_{char}) function in the char burn-off kinetics.)



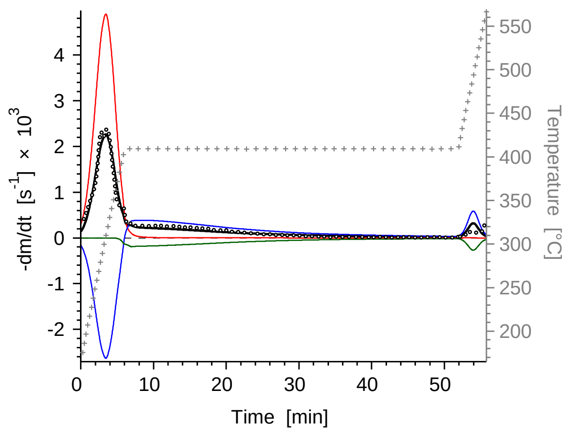
Burley blend, G_0=2.0mg C_{O2}=0.09, 4°C/min
fit_1: 6.84%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 $\sigma(E)$=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10} A$=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



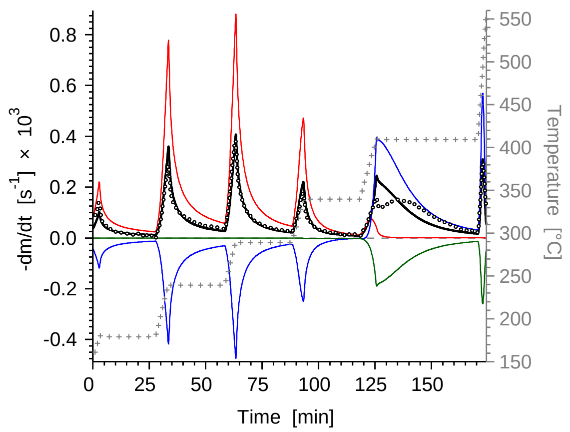
Burley blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 7.94%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 $\sigma(E)$=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10} A$=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



Burley blend, G_0=0.4mg C_{O2}=0.09, 40°C/min
fit_1: 6.29%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 $\sigma(E)$=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10} A$=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



Burley blend, G_0=1.0mg, C_{O2}=0.09 40°C/min, 45' at 409°C
fit_1: 2.75%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 $\sigma(E)$=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10} A$=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456



Burley blend, G_0=2.0mg C_{O2}=0.09, stepwise T(t)
fit_1: 6.25%; fit_{30}: 6.99%
1: E_0=181.7 $\log_{10} A_0$=14.86 $\sigma(E)$=25.4 yield=0.537 beta=0.0708
2: E= 212.4 $\log_{10} A$=14.45 n=1.92 a=3.09 z=0.014
ν=0.416 yield=0.456

Figure 3/f (Model assumptions: DAEM with variable preexponential factor and an empirical $f(\alpha, m_{char})$ function in the char burn-off kinetics.)