# Fitting lines to data

Tuesday, December 29, 2020 3:35 PM

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import matplotlib.pyplot as plt
from scipy.optimize import curve_fit
import pandas as pd
import numpy as np
import matplotlib as mpl
import seaborn as sns

mpl.rcParams['pdf.fonttype'] = 42
mpl.rcParams['font.size']=14

filename = r'data_for_exercises/avrami steel.xlsx'
df = pd.read_excel(filename)
x400 = df['400x'].dropna()
y400 = df['400y'].dropna()
x450 = df['450x'].dropna()
y450 = df['450y'].dropna()
x482 = df['482x'].dropna()
y482 = df['482y'].dropna()
x551 = df['551x'].dropna()
y551 = df['551y'].dropna()



k = np.empty(4)
n = np.empty(4)

Temp = np.array([400,450,482,551])
Temp = Temp+273
invTemp = 1. / Temp

def avrami(x,k,n):
    return  1-np.exp(-k*x**n)

fig = plt.figure(1, figsize=[6,6])

colors = sns.cubehelix_palette(6, start=2)
```

```
popt, pcov = curve_fit(avrami, x400, y400)
k[0]=popt[0]
n[0]=popt[1]
plt.semilogx(x400,y400,marker='o', color=colors[0], markersize=11, mfc='white')
plt.semilogx(x400, avrami(x400, *popt), color=colors[0], label='450$^o$C, fit: k=%5.4f, n=%5.3f'
% tuple(popt))

popt, pcov = curve_fit(avrami, x450, y450)
k[1]=popt[0]
n[1]=popt[1]
plt.semilogx(x450,y450,marker='o', color=colors[1], markersize=11,mfc='white')
plt.semilogx(x450, avrami(x450, *popt), color=colors[1], label='450$^o$C, fit: k=%5.4f, n=%5.3f'
% tuple(popt))

popt, pcov = curve_fit(avrami, x482, y482)
k[2]=popt[0]
n[2]=popt[1]
plt.semilogx(x482,y482,marker='o', color=colors[2], markersize=11,mfc='white')
plt.semilogx(x482, avrami(x482, *popt), color=colors[2], label='482$^o$C, fit: k=%5.4f, n=%5.3f'
% tuple(popt))

popt, pcov = curve_fit(avrami, x551, y551)
k[3]=popt[0]
n[3]=popt[1]
plt.semilogx(x551,y551,marker='o', color=colors[3], markersize=11,mfc='white')
plt.semilogx(x551, avrami(x551, *popt), color=colors[3], label='551$^o$C, fit: k=%5.4f, n=%5.3f'
% tuple(popt))


plt.minorticks_on()
plt.tick_params(direction='in',right=True, top=True, left=True, bottom=True)
plt.tick_params(labelbottom=True, labeltop=False, labelright=False, labelleft=True)
plt.tick_params(direction='in',which='minor', length=5, bottom=True, top=True, left=True,
right=True)
plt.tick_params(direction='in',which='major', length=10, bottom=True, top=True, left=True,
right=True)
plt.xlim([0.1,1e5])
plt.xlabel('time (s)')
plt.ylabel('fraction transformed')
plt.legend(fontsize=14)
```

```
plt.savefig('data_for_exercises/plotting/avrami.png', dpi=300,bbox_inches="tight")
```