Notebook

February 17, 2020

NBBinder test on a collection of notebooks about some thermodynamic properperties of water

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1 Reading the Data

A table with the variation of density and viscosity in terms of the temperature, at a fixed pressure of 1 atmosphere, is available in Batchelor (2000). The data has been digitized and saved into a local `csv` file. Here we load the table from the file and view and plot the data.

1.1 Importing the libraries

First we import the libraries used in this particular notebook.

[1]:
```
import pandas as pd
import matplotlib.pyplot as plt
```

1.2 Using pandas

The data has been digitized to the local file `water.csv`. An easy way to retrieve it is with the pandas.read_csv() function of the `pandas` library:

[2]:
```
water_pd = pd.read_csv('water.csv', header=[0,1])
```

1.2.1 Viewing the data with pandas

The data is diplayed nicely with pandas:

[3]:
```
water_pd
```

[3]:

temp	density	viscosity
Temperature (C)	Density (g/cm^3)	Viscosity (cm^2/s)

0	0	0.9999	0.01787
1	5	1.0000	1.51400
2	10	0.9997	1.30400
3	15	0.9991	1.13800
4	20	0.9982	1.00400
5	25	0.9971	0.89400
6	30	0.9957	0.80200
7	35	0.9941	0.72500
8	40	0.9923	0.65900
9	50	0.9881	0.55400
10	60	0.9832	0.47500
11	70	0.9778	0.41400
12	80	0.9718	0.36600
13	90	0.9653	0.32700
14	100	0.9584	0.29500

1.2.2 Plotting the data

We may also visualize both variations of density and viscosity using `matplotlib.pyplot`:

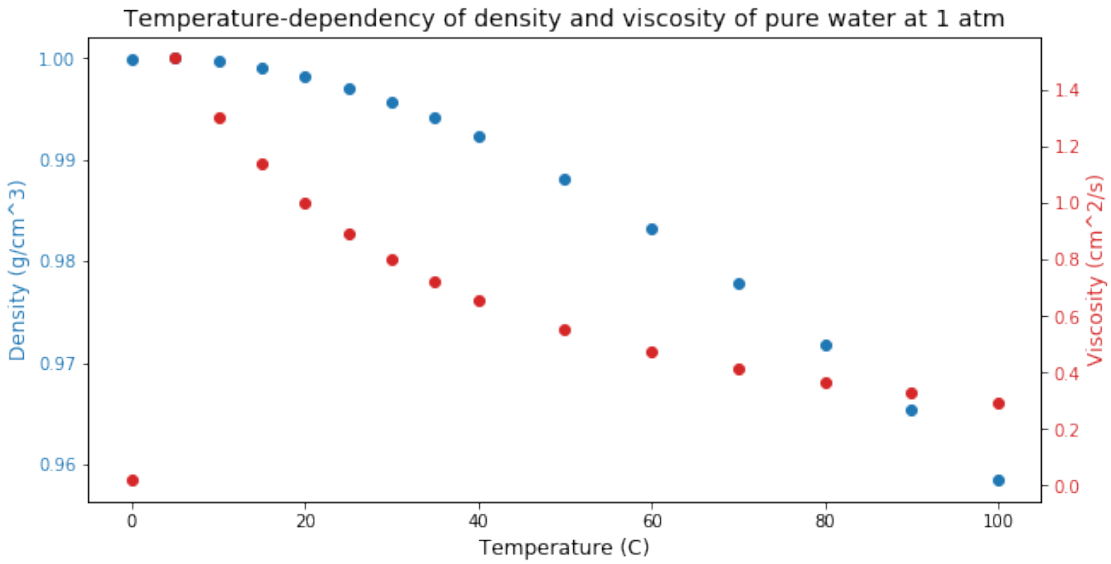
[4]:
```
fig, ax1 = plt.subplots(figsize=(10,5))

color = 'tab:blue'
ax1.set_xlabel(water_pd['temp'].columns[0], fontsize=12)
ax1.set_ylabel(water_pd['density'].columns[0], color=color, fontsize=12)
ax1.plot(water_pd['temp'], water_pd['density'], 'o', color=color)
ax1.tick_params(axis='y', labelcolor=color)

ax2 = ax1.twinx()

color = 'tab:red'
ax2.set_ylabel(water_pd['viscosity'].columns[0], color=color, fontsize=12)
ax2.plot(water_pd['temp'], water_pd['viscosity'], 'o', color=color)
ax2.tick_params(axis='y', labelcolor=color)

plt.title('Temperature-dependency of density and viscosity of pure water at 1␣
 ↪atm',
          fontsize=14)
plt.show()
```



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