

Review of “Maxwell-Stefan diffusion: a framework for predicting condensed phase diffusion and phase separation in atmospheric aerosol” by Fowler et al.

This article proposes a Maxwell-Stefan diffusion framework in an atmospheric core-shell model for the interactions of compositions of aerosols with water vapors. This is an interesting and important topic because aerosol microphysical process affects many processes in the atmosphere, such as atmospheric cloud formations and eventually the global energy budget. And more importantly, there are still large uncertainties in our current climate models to represent this. It is a challenge for climate models to appropriately represent the aerosol formations and activation. This study is well within the scope of ACP, with sound model design. It deserves the publication in ACP after all of my comments are properly addressed.

Page 1, line 17: the size or mass of aerosols vary by orders of magnitude? This is need to be clearly stated.

Page 2, line 9: “D the Fickian coefficient typically describing ideal diffusion properties’ should be changed to “D is the Fickian coefficient that describes the ideal diffusion properties”.

Page 2, line 11: what is Fick’s first and second laws? Equations (1) and (3) respectively? Readers need a clear message here.

Page 2, line 16: there should be a “,” after however.

Page 2, lines 17-19: “There is also great uncertainty in measurements of diffusion, the current best estimates of diffusion rates.....” should be changed to “There is also great uncertainty in measurements of diffusion. For instance, the current best estimates of diffusion rates.....”

Page 2, lines 20: I suggest that the authors should explicitly describe the Stokes-Einstein equation here because most of readers are not familiar with this.

Page 3, line 2: “Furthermore, when multicomponent systems are considered the Fickian model is not generally.....” should be changed to “Furthermore, when multicomponent systems are considered, the Fickian model is not generally.....”.

Page 3, line3: add a comma, after “For these reasons”.

Page 4, Figure 1: the caption of last sentence seems to be confusing. Please re-write.

Page 5, line 17: change the typos of “coefficientis” to “coefficient is”.

Page 5, line 21: what is UNIFAC? This needs to be briefly explained.

Page 5, line 21: change “activities” to “activity coefficient”.

Page 6, line 9: add comma after “however”.

Page 7, caption of Figure 2: change “equal” as “equals”.

Page 8, line 4: add a comma after “To investigate the model sensitivities”.

Page 8, line 9 and line 14: again, add a comma after “Figures 3 and 4”.

Page 8, lines 5-6: what are the different values of the self diffusion coefficient? what are the three different relative humidity? Authors need to explain them clearly here.

Page 12, line 9: “by” should be deleted here.

Page 12, line 10: there should be a comma between “horizontal” and “indicating”.

Page 12, line 12 and 17: again, comma needs to be added after “Figure 2” in line 12 and “Figure 15 in line 17.

Page 19, lines 30-31: O'Meara et al. (2016) should be updated from ACPD to ACP.