The author's text in italics, the referee comments in plain text.

General comments:

Shen et al. present a new algorithm for the size-resolved correction of the hygroscopicity, κ considering shrinking effect caused by to multi-charge number contribution. I recommend this manuscript to be published in AMT after the following issues to be addressed and modified.

Major comments:

1. The term "shrinking effect" seems to be unfortunate, since it used for actual irregular particles restructuring in the humid conditions caused by surface or capillary forces of absorbed/adsorbed water. To avoid confusion I recommend using another term, say "compression effect" or "displacement effect".

2. The shrinking function $S(i, v)$ is not properly described in the text. Please show which expression/algorithm was used to calculate it.

3. The multi-charge algorithm for hygroscopicity correction has not been properly tested. As a first step, I would suggest to apply it for single-component particles (100; 200, and 300 nm) with well-defined thermodynamic and hygroscopic properties, ammonium sulfate as an example. Please show the particle's growth factors change taking into account (x,v), $\Omega(x,v,i)$ and $S(i, v)$ and then κ initial and κ corrected as a function RH.

4. Due to typos and errors, the text is difficult to read.

Minor comments:

Page 1, line 30: *Swietlicki et al.* should be Swietlicki et al., 2008;
Page 2, Line 33: (*Cubison, Coe, & Gysel, 2005; Gysel, McFiggans, & Coe, 2009; Stolzenburg & McMurry, 2008; Voutilainen, Stratmann, & Kaipio, 2000*). Correct citation according to AMT instruction,
  Line 41: *"Duplissy et al. (2008) obtained ..."* Note, Gysel et al., 2009 obtained the kernel function, Duplissy et al. (2008) just used it for multi-charge correction.
  Line 42 *"GFs"* The abbreviation is not defined.
Page 3, Line 70, please define the scale parameter x once.
  Line 74, term *n(x)* is not defined.
  Lne   77, Fig, 1b . *The corresponding ratio of particles carrying different charges is calculated from the PNSD using the abovementioned DMA electrical mobility and charging theory.* Please specify in detail how data in Fig.1b were obtained? Show in the explicit form the (x,v) and $\Omega(x,v, i)$, at least in Supplement.
  Line 80 *For example, when we set 100 nm in the first DMA, more than 40% of the selected particles are multiply charged.* Please double check a 40 % value. How it was obtained?
Page 3, line 88. *An illustration figure (Fig.2) was shown to explain the cause of this shrinking effect* Correct the sentence.
Page 4, Line 117 *…where x is the scale parameter.* It was defined in page 3, line 70.
  Line 122 *So the **question** can be simplified as the following.* Change to **equation.**
Page 5, Line 132 *One hypothetical κ distribution along with the corresponding multi-charge corrected κ distributions are shown in Fig.4.* Here is discrepancy between "hypothetical κ distribution**"** in the text and "*measured κ distribution***"** in the Fig.4 captions. Is it measured or hypothetical κ distribution?

Page 6, Line 156, Eq.(12) $C(i,x)$ *represents the correction factor caused by the shrinking effect*
In Eq.(6) the correction factor was defined as $S(i, v)$. Is it the same or new one?
Line 160, … *the **question** can be simplified into*… Change to **equation**.
Line 167 … *distributions are also shown in **Fig.4**.* Change to **Fig.5**.
References Page 9, line 283

*Wiedensohler, A., Lütkemeier, E., Feldpausch, M., & Helsper, C. (1986). Investigation of the bipolar charge distribution at various gas conditions. Journal of Aerosol **ence, 17(3), 413-416**.*
Should be:

Wiedensohler, A., Lütkemeier, E., Feldpausch, M., and Helsper, C.: Investigation of the bipolar charge distribution at various gas conditions, J. Aerosol Sci., 17, 413-416, https://doi.org/10.1016/0021-8502(86)90118-7, 1986.

 Please follow the AMT instruction for paper submission, especially references and citation section.