Reply to the comments by Lijun Wang on manuscript Entitled "Dynamic shape factor and mixing state of refractory black carbon particles in winter in Beijing using an AAC-DMA-SP2 tandem system"

We are grateful to you for interested in this research and providing comment. We try our best to answer the question. As you mentioned, there are indeed 3 unknown variables in the equation (4) and (6). In calculation, the density of particles was presumed to be 1.77 g/cm^3 based on the following reasons: (1) during pollution period, inorganic matters in PM_1 (measured by ACSM) mainly consist of sulfate, nitrate and ammonium. We adopt the particle density of sulfate ammonium. (2) According to uncertainty analysis, the uncertainty of density of particles is a main contributor. In this study, we found that total uncertainty was found to be 7.2%, including the uncertainty of mobility diameter ($\varepsilon_{dmo}/d_{mo} \approx 3\%$), the uncertainty of aerodynamic diameter ($\varepsilon_{dae}/d_{ad} \approx 2\%$), the uncertainty of slip correction ($\varepsilon_{Cc}/Cc \approx 2.1\%$), the uncertainty of density of particle ($\varepsilon_{\boldsymbol{\rho}p}/\boldsymbol{\rho}_p \approx 10\ \%$). The detailed description about the uncertainty analysis is in literature (Tavakoli and Olfert, 2014), we will add the discussion in the revised manuscript. (3) From calculation consideration, adoption of a smaller particle density (i.e. 1.5 g/cm^3) resulted the chi value to be less than 1.0, inconsistent with theoretical estimation. As a matter of fact, the effective density of particles (normally much smaller than the density of particles due to irregular structure) in Beijing was reported to be 1.43-1.45 g/cm^3(Kai et al., 2018), suggesting that the value we adopted is reasonable.
We will add the missing information in the revised manuscript.
If any request, please contact with me via panxiaole@mail.iap.ac.cn.

Reference:

Kai Q., Zhijun W., Xiangyu P., et al., (2018), Size-resolved effective density of submicron particles during summertime in the rural atmosphere of Beijing, China, Journal of Environmental Sciences, volume 73, Pages 69-77, https://doi.org/10.1016/j.jes.2018.01.012.