We thank the editor for providing helpful suggestions to improve the manuscript. Below we have included our responses in red. In the revision of this manuscript, we have highlighted those changes accordingly.

Editor comments are in blue; manuscript text in black.

1) Your new text in lines 75 – 79 seems out of place and misleading.

Modern gasoline direct injection (GDI) vehicles can emit plentiful ultrafine BC containing (soot) particles in the ambient (La Rocca et al., 2015; Hu et al., 2021).

The paragraph is about mixing state of soot particle. However, the information on size range of BC particles should come first, after the sentence in that starts in l. 58 (Black carbon is the most...). Please add not only the references by La Rocca 2015, and Hu et al., 2021 but also a reference that reports on BC in larger particles. For example, you could add briefly some information you wrote in the author response to the first editor comment.

RE: The sentence "Modern gasoline …" is deleted. The sentence "Soot particles are abundant in both nucleation and accumulation modes (Li et al., 2011; Levy et al., 2013; La Rocca et al., 2015; Hu et al., 2021; Zhang et al., 2021)." is added in line 63-65. The references of Levy et al. (2013) and Zhang et al. (2021) suggests that soot particles in accumulation mode are also abundant in the ambient.

The tiny soot particles embedded in other material (such as sulfate) play a significant role in particle growth (Li et al., 2011).

This sentence implies that the soot itself leads to particle growth. This is not reflected in the article by Li et al., 2011. They only say that particle growth occurs on particles that contain soot – among other components. Please reword it or remove sentence.

RE: This sentence is deleted.

Investigating the mixing state of BC-containing particles and their factors in different modes are needed.

This sentence seems out of place or redundant after the preceding paragraph where the role of mixing state is already discussed.

RE: This sentence is deleted.

2) l. 258: These tiny soot particles in nucleation mode are mainly from modern vehicle emissions (La Rocca et al., 2015; Hu et al., 2021)

The referee requested that *" Again, the authors need to demonstrate that the very volatile nucleation mode particles contain soot before discussing the high volatility of nucleation-mode soot particles"*

The simple addition of your statement that these particles are composed of soot is not sufficient to address the referee's concern. As pointed out by the referee, commonly it is assumed that soot particles are not (necessarily) highly volatile. How can you be sure that it was the case in your study? A brief discussion of this may deserve a separate paragraph as it is essential for the conclusions of your study.

RE: The fraction of VV-mode particles is high for the nucleation-mode (40-nm and 80-nm) particles shown in Fig. 3. The VV-mode (SF≈0.4) residual soot size of most 40-nm particles after heating at 300ºC was about 16 nm. And the VV-mode residual soot size of most 80-nm particles after heating at 300ºC was about 32 nm. Hu et al. (2021) found ultrafine soot particles in diameter below 23 nm take up majority of particle emissions from a China VI vehicle. La Rocca et al. (2015) reported that primary soot particles from the emission of light-duty EURO IV GDI engine presented an average diameter of 36 nm with a mode of 32 nm. Moreover, our measurement site (Xingtai) is located in the severe polluted area with kinds of anthropogenic sources including the high intensity of vehicle emissions. Therefore, it is excepted that these soot in nucleation mode are plentiful and mainly from vehicle emissions. Extremely low-volatile organics are another possible component in this size. However, these extremely low-volatile organics are mainly formed in the forest area (Ehn et al., 2014), which is not in line with where we were measuring. We added more discussion in the manuscript.