

Interactive comment on “Formation mechanisms of atmospheric nitrate and sulfate during the winter haze pollution periods in Beijing: gas-phase, heterogeneous and aqueous-phase chemistry” by Pengfei Liu et al.

Anonymous Referee #2

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This study focused on the formation mechanisms of nitrate and sulfate in Beijing, especially the different mechanisms under various RH conditions. The heterogeneous hydrolysis of N₂O₅ was responsible for the nocturnal formation of nitrate at extremely high RH levels (RH>60%), while homogeneous reaction between NO₂ and OH radical dominated the formation under moderate condition (30%<RH<60%). For SO₄²⁻, aqueous reaction between SO₂ and H₂O₂ attributed to its formation under high RH condition. The target of this study is meaningful to understanding the formation mechanism of nitrate and sulfate in real atmosphere. There are several questions not very clear.

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Comments: 1. Please give a brief description of NOR and SOR in abstract. 2. Did NOR and SOR represent the secondary formation of NO₃⁻ and SO₄²⁻, respectively? Actually, when NO_x and SO₂ reached zero, the value of NOR and SOR were closed to the maximum. If NOR and SOR represent the secondary formation of NO₃⁻ and SO₄²⁻, secondary formation of NO₃⁻ and SO₄²⁻ showed up with low concentration of NO_x and SO₂. This result is confusing. 3. The authors mentioned that “The reduction of NOR might be due to the deliquescence of nitrate at atmospheric RH around 60 %” at line 270-271. However, the deliquescence of nitrate would not reduce the nitrate in particle but change its phase state. RH has been validated to affect the heterogeneous reaction of NO_x and HONO, which may result in the reduction of nitrate at high RH condition. 4. One N₂O₅ could be generated by two NO₂ reacting with one O₃. Hence, is it more suitable to use $[\text{NO}_2]^2 \times [\text{O}_3]$ rather than $[\text{NO}_2] \times [\text{O}_3]$ for representing the heterogeneous hydrolysis of N₂O₅ to atmospheric nitrate at night? 5. Though HONO is a main source OH, the diurnal variation of HONO may be different from OH radical. Have the author ever analyzed the correlation between DR × NO₂ and NOR? Because the diurnal variation of OH radical should be highly correctly with radiation.

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