This study quantified and characterized nearly all organic carbon in the laboratory oxidation of biomass burning (BB) emissions through combined mass measurements (AMS, PTR, and I-CIMS). There are several unique elements of this work, including the focus on BB organic species conversion and formation. Generally, the authors provide good context for the work and appropriate references are cited. It is very valuable work. Several specific technical and technical comments are provided below. With minor revisions, the manuscript may be appropriate for publication in ACP.

Specific comments:

1. Line 101 What is the specific concentration or approximate range of fresh plum before aging, and how to define the maximum concentration of particle? The initial concentration of BB plume is very important for the subsequent aging process.

2. The actual OH concentration/exposure in the PFA during the course of each experiment needs to be given if measured.

3. There is a large amount of ozone in the chamber during the experiment. Over the course of the reaction, not only the OH radicals-driven oxidation reaction but also the ozone-driven oxidation reaction. How can the authors prove that OH oxidation dominated in the oxidation mechanism and how much uncertainty will be caused by the existence of high concentration ozone in calculating the equivalent aging time?

4. High-NO (RO2+NO) and low-NO (RO2+HO2) conditions are very important for the aging reaction and oxidation products. The author also stressed this point, but the follow-up manuscript did not pay attention to these chemical regimes, resulting in this part of the content was not well handled.

5. As discussed in the manuscript, only 134 PTR ions and a small subset of CIMS ions were calibrated directly. Can the authors give detailed information about the identified species, such as a table? Another question, I would like to know whether all 763 unique gas-phase species calculated the carbon oxidation state, volatility, and oxidative lifetime, or only identified ions. I wonder if you use different species in the calculation and if it will change the graph.

6. What is the concentration and formation rate of OA measured by AMS over the reaction? The evolution of actual OA concentration cannot be seen in Figure 1. How did the authors calculate the carbon concentration of OA? I can not find the calculation processes in the manuscript. As the author confirmed that the increased abundance of a handful of small VOCs is driven by fragmentation reactions, however, fragmentation reactions generally lead to the reduction of OA (doi.org/10.5194/acp-11-3303-2011, doi.org/10.1002/2014JD022563). Does this conflict with the growth of OA?

7. What is the reason for the decrease in carbon concentration of AMS, I-CIMS, and PTR in the

initial stage in Figure 1?

8. Are the species in Table 2 only measured by PTR or were detected by both instruments? Can you mark which instrument detected these species respectively?

9. The authors emphatically analyzed the Fire 25 and Fire 26 experiments. The two groups of experiments used the same fuel and got similar commons. However, the MCE and moisture content of these two groups of fuels are significantly different. Many previous field and laboratory studies have emphasized the aging process of high MCE (flaming) and low MCE (smoldering) and found that there are great differences, including the SOA formation, the oxidation state of OA, and gaseous oxidation products (doi:10.1029/2021JD034534), change of optical properties (10.1021/acs.est.0c07569), and the influence of aerosol emissions from wildfires driven by MCE (doi.org/10.1021/acs.est.6b01617). Will this factor probably influence your results, which may be worth some discussion and explanation?

Technical corrections:

Line 34, the comparison of mass spectra
Line 127, in the measurement
Line 136, delete the second “and”
Line 144, due to the unavailability of standards,
Line 301, each of the individual fires becomes...