Experimental studies of the formation of cluster ions formed by corona discharge in an atmosphere containing SO$_2$, NH$_3$, and H$_2$O

**Abstract**

We report on studies of ion-induced nucleation in a corona discharge taking place in an atmosphere containing SO$_2$, NH$_3$, and H$_2$O at standard temperature and pressure. Positive ions such as H$_3$O$^+$(H$_2$O)$_n$, NH$_4^+$(H$_2$O)$_n$, and H$^+$(H$_2$SO$_4$)(H$_2$O)$_n$ and negative ions such as HSO$_5^-$-(H$_2$O)$_n$, SO$_4^-$-(H$_2$O)$_n$, HSO$_4^-$-(H$_2$O)$_n$ and NO$_3^-$-(H$_2$O)$_n$ have been recorded. Large values of $n (>100)$ were observed and the experiment indicates the existence of even larger water clusters. In contrast, only clusters with a maximum of 2 sulfuric acid molecules were observed. Fragmentation studies also revealed that the negative ion HSO$_5^-$, which has been observed in many studies, in our experiments is contaminated by O$_2^-$-(HNO$_3$)(H$_2$O) ions, and this may also have been the case in other experiments. Finally an ion with m/z = 232 (where m is the cluster mass in amu and z is the charge state), capable of attaching H$_2$O-molecules was observed and studied by fragmentation.

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