The chemical and physical properties of atmospheric pollutants and the effects of dust-haze

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Abstract: Heterogeneous chemical reaction on the surface of the atmospheric fine particulate matters not only involves the chemical and physical properties of fine particulate matters itself,but also with the concentration of trace gases in the atmosphere and environment are closely related.To study the reaction products and there reaction mechanism ,so as to determine the actual fine particulate matters in the atmosphere on the surface of the heterogeneous chemical reaction control and the impact of the atmospheric environment.So,first,must carry on the research of the chemical and physical properties of atmospheric pollution.

Introduction

Rapid advance of industrialization and urbanization,in the human social development and the progress of social civilization at the same time also brought unprecedented environmental pollution.Belgian maas river valley of smoke、Lodon smog、Los Angeles photochemical events、The green house effect、Global warming and the eastern part of our country continuous haze weather are closely related to the atmospheric pollution of the environment[1、2].Especially after the reform and opening up, with the rapid development of national economy, the rapid growth of our country for the global processing center, the rapid development of industrial production, resource consumption, a large number of growth, energy use multiply, coupled with increasing amount of vehicles, the SO2, NOx, and PM10 and PM2.5, VOCs, pollutants emission and interact with each other, make the basic pattern of atmospheric compound pollution in our country, continuous large haze weather has caused the eastern part of our country, to the people's production, daily life and health have brought great harm.In this case, the study of mechanism of combined air pollution in China is of great significance[3-5].

Atmospheric pollutants research of physical and chemical properties

Heterogeneous chemical reaction on the surface of the atmospheric fine particulate matters not only involves the chemical and physical properties of fine particulate matters itself,but also with the concentration of trace gases in the atmosphere and environment are closely related.To study the reaction products and there reaction mechanism ,so as to determine the actual fine particulate matters in the atmosphere on the surface of the heterogeneous chemical reaction control and the impact of the atmospheric environment.So,first,must carry on the research of the chemical and physical properties of atmospheric pollution.

Atmospheric particulate matter is made up of many different emissions of man-made or natural,it is a mixture of chemical composition of complex material, including water soluble ionic

components, there is both stable component and semivolatile component,including ammonium nitrate、SVOCs and steam.

Generally,the discharge pollutant of artificially gathered in the water-soluble components.Water-soluble ionic components are one of the most important chemical components of the atmospheric particulates.The ionic component of the atmospheric particulates,such as the cation like $NH4^+$、Na^+，Mg^{2+}，K^+，Ca^{2+} etc. and the anion like PO_4^{3-}，SO_4^{2-}、NO_3^-，Cl^-，F^-，Br^- etc..$NH4^+$ and SO_4^{2-} mainly exists in the fine particulate matter modal,and NO3- exists in both coarse and fine particulate matter modal.Its particle size distribution is closely related to the geographical location and weather conditions.NO_3^-、$NH4^+$and SO_4^{2-} of the PM2.5 mainly come from the gas-particles conversion.Their concentrations are concerned with the concentrations of gas precursors such as SO_2、NO_x and NH_3^-.And the percent conversions of particles in the atmosphere.And influenced by temperature and humidity etc.

The carbonaceous components also known as carbonaceous particles or carbonaceous aerosol,are one of the most important components of the atmospheric particulates.Those are also one of the selective control of atmospheric pollutants in the typical areas of China.The carbonaceous components including OC. EC.and carbonate carbon.OC.on behalf of a large number of organic compounds,including aliphatic compounds,aromatic compounds,organic acids etc.EC is a complex mixture,contains pure carbon,graphite carbon and non-volatile,high relative molecular mass,black organic matter(such as tar,coke,etc.).Therefore the OC and EC only have the significance of laboratory analysis.

The research of heterogeneous chemical reaction for atmosphere pollutants

The heterogeneous chemical reaction on the surface of fine particulate matters not only involves the physical and chemical characteristics of fine particulate matter itself, but relate to the trace gases concentration and environment in the atmosphere,so it is difficult to achieve the heterogeneous chemical reaction on the surface of fine particulate matters in the atmosphere. In the process of the actual research, always use a single component of particulate matters simulate one of the ingredients of the fine particulate matters in the real atmosphere to react with the trace gases, or collect the fine particulate matters in the atmosphere to react with the trace gases,, study the reaction products and their reaction mechanism, so as to infer the actual fine particulate matter in the atmosphere on the fine particulate matters in the atmosphere.

A. SO_2's heterogeneous chemical reaction on the surface of the fine particulate matters

SO_2 is one of the important component of the atmosphere,it is also one of the main causes of acid rain formation, and sulfate granules have obvious effect to the increase in the number of cloud condensation nuclei in the atmosphere.So it is important that knowing the mechanism of SO_2 in the troposphere have been extensively studied. SO_2's heterogeneous chemical reaction on the surface of the attention of the researchers.

B.The heterogeneous reaction of Nitrogen oxides on the surface of the particles

Nitrogen is also one of the main atmospheric pollutants, in the troposphere chemical reaction,the heterogeneous chemical reaction of nitrogen oxides on the surface of the fine particulate matter is important . Generally ,NOx includes NO and NO_2, but the total reactive of nitrogen NO_y including NO、NO_3、N_2O_5、HNO_3、PAN and other organic nitrates. In the atmospheric

environment ,NO will be oxidized to NO_2、NO_3 and N_20_5 etc..they are important source of acid rain. In addition, NO coexist with hydrocarbons will form photochemical smog under direct sunlight.It will cause serious secondary pollution.So the chemical conversion of NO has been important content of atmospheric chemistry research.

Around the world, the sea salt particles caused by the waves of droplets into the troposphere will reached 10^{12}kg.It provides considerable reaction interface for heterogeneous reaction.Because the troposphere can produce reactive halogen, the heterogeneous reaction of HNO_3 in the atmosphere on the surface of the sea salt particles has been paid much attention .Since NaC1 is the main component of sea salt particles, it can be concluded that the heterogeneous reaction of NO_2 in the boundary layer of the ocean and sea salt particles may not be important. Finlayson - Pitts found that the heterogeneous reaction of N_2O_5 which on the surface of sea salt particles can change the oxidation ability of atmosphere.

C.Heterogeneous chemical reaction of O_3 on the surface of the particles

The heterogeneous chemical reaction which O_3 reacts on the surface of fine particulate matters directly influence its loss in the atmosphere and atmospheric photochemical oxidation process.The reaction probability which O_3 reacts on the most of the fine particulate matters' surface is unclear, but on the soot particle loss has been underway for more research.

Smith founds that solar irradiation will change the rate distribution of ozone and soot reaction productCO2(g)、CO(g) and the H20 (g), however, it has no effect on ozone concentration or cut rates. The flowing tube reactor was used to study the adhesion coefficient which ozone on ice crystals and ammonium sulfate and ammonium sulfite permeability ice crystals by Yu-jing Mu.This study has shown that adhesion coefficient of ozone in low temperature ice crystals' surface increases with temperature increasing, but presents non-linear relation to the concentration of ammonium sulfate and ammonium sulfite permeability ice crystals , at the same time by using the results, calculated the ozone in the polar stratospheric clouds there life is about 56 days, which showing that ozone's loss on the surface of main component of water ice crystals should not be ignored. And atmospheric light oxidant and particle interaction can make ozone concentration is reduced about 10%, thereby affect the circulation process of photochemical oxidants in atmospheric environment.

D.Organic matters' heterogeneous chemical reaction on the surface of the fine particulate matters

There are many different kinds of organic pollutants in the atmosphere, The recognition of organic pollutant's type can provide the information of characteristics and source of organic matter in aerosols and the the influence to human body’s health , such as the analysis of the type for polycyclic aromatic hydrocarbons in the fine particulate matters. Although people have realized that organic matters in aerosols playing an important role on the atmospheric environment and climate change, but its mechanism is still not clear, needing to be studied deeply.

Conclusion and prospect

Complex combined air pollution and the secondary fine particulate matters are the main reasons for the dust—haze in our country. In addition, because there is a big difference in the pollution at home and abroad, makes the study of dust–haze cannot draw lessons from foreign result directly.We should make different control strategies according to China's pollution situation and the economic level of different areas .Dust- haze is a pollution phenomenon that is caused by high

concentrations of atmospheric particulates which reduced extinction, and the properties of extinction is closely related to atmosphere's physical and chemical process. Strong hygroscopicity of sulfate hygroscopic growth rapidly in high humidity environment, can promote its extinction effect, resulting in a decline in atmospheric visibility and this is an important reason of haze. Studies have shown that NO_2 and SO_2 can promote transfer of SO_2 to sulfate, but its heterogeneous reaction mechanism is not clear. Future research can study the reaction mechanism further by the smoke box which is closer to the atmospheric environment,With ACSM,it is feasible to confirm that NOx and suspended mineral oxides particles' promoting effect to producing sulphate.This provide new theoretical basis for explaining our frequent haze phenomena and controling it in a scientific way.

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