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Overview of speciated mercury at anthropogenic emission sources

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Distribution of speciated mercury from anthropogenic emission sources is crucial to mercury transport and deposition in the atmosphere and its impacts on the environment. Coal combustion (CC), cement production (CP), non-ferrous metal smelting (NFMS), and iron and steel production (ISP) are predominant emission sources. With the decline of the flue gas temperature out of boiler/kiln/furnace/sinterer, part of gaseous elemental mercury (Hg^0) is oxidized to gaseous divalent mercury (Hg^{2+}) both homogeneously and heterogeneously, and part of Hg^{2+} is adsorbed onto fly ash to form particulate-bound mercury (Hg_p). Initial mercury speciation in the flue gas varies significantly, which is mainly determined by properties of fuels or raw materials. Halogen is the main oxidizer for Hg^0 in flue gas, and active components on fly ash have considerable impact on the heterogeneous oxidation process and the adsorption process. Air pollution control devices (APCDs) affect the distribution of different mercury species. Electrostatic precipitator (ESP) and fiber filter (FF) remove over 99% of Hg_p and wet flue gas desulfurization system (WFGD) captures 60-95% of Hg^{2+} . Selective catalytic reduction system (SCR) largely promotes mercury oxidation. Acid plants (APs) in NFMS absorb a large amount of Hg^{2+} and convert most of Hg^0 to Hg^{2+} . After all, Hg_p accounts for no more than 5% in the ultimate flue gas for all these sectors. For a typical CFPP, Hg^{2+} takes up about 1/3 of the total in exhaust flue gas. The proportion of Hg^{2+} exhausted from CP, NFMS and ISP is in the range of 50-90%.

Biography

Shuxiao Wang is a full professor of Environmental Science and Engineering at Tsinghua University and Executive Deputy Director of the State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, China. She is a leading scientist in the emissions and control of multiple air pollutants generated from energy use activities. Her research group has conducted fundamental research on emission characteristics, regional transport, atmospheric chemistry and control policies of air pollutants including mercury. She has published more than 100 peer-reviewed articles in top international journals, several books and book chapters.

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