

发电

不同煤燃烧源排放的PM10形态及重金属分布的对比研究

岳勇 姚强 宋蕾 李水清 王琿

清华大学热科学与动力工程教育部重点实验室 清华大学热科学与动力工程教育部重点实验室 清华大学热科学与动力工程教育部重点实验室 清华大学热科学与动力工程教育部重点实验室 清华大学热科学与动力工程教育部重点实验室

摘要: 对3种煤燃烧源(煤粉炉、水煤浆炉和CFB炉)形成的飞灰颗粒直接进行了烟道源环境采样,使用8级Andersen撞击器按空气动力学粒径分级采集样品。分级的样品进行SEM(扫描电镜)和ICP-AES(电感耦合等离子原子发射光谱仪)分析,获得颗粒物的微观形态和8种元素(As、Pb、Cr、Cd、Ni、Co、Cu、Zn)在不同粒径飞灰上的分布富集数据。结果显示,煤粉炉和水煤浆炉的PM10微观形态以球形颗粒为主,数量超过90%,但CFB炉中则以不规则、片状和絮状颗粒为主。煤燃烧中元素富集特性的强弱结果为:As>Pb>Cd、Zn>Ni>Co>Cu、Cr。煤粉炉和水煤浆炉中,元素随粒径减小以成倍速度富集,最末级(粒径最小)上As的相对富集因子分别为30、23,Pb的相对富集因子为16和13,Ni、Co、Cu、Cr也有4~8倍的富集;CFB炉中元素无明显富集现象,燃烧温度是主要影响因素。

关键词: PM10 扫描电镜 重金属 煤燃烧

Comparative Study on PM10 Microstructure and Heavy Metals Distribution in Emissions of Coal Combustion Sources

Abstract: Three different sources of fly-ash particles were directly sampled from a pulverized coal-fired (PC) boiler, a coal-water mixture fired (CWM) boiler and a circulating fluidized bed (CFB) boiler in flue by 8-stage Andersen impactor with aerodynamic diameter separation. Characteristics of samples in different stages were analyzed by means of a scanning electron microscopy (SEM) and an inductively coupled plasma atomic emission spectrometry (ICP-AES). The microstructures of PM10 and enrichment quantities of 8 elements (As, Pb, Cr, Cd, Ni, Co, Cu, Zn) in different size particles were studied. The results show that over 90% of PM10 particulates from PC and CWM boilers are in regular spherical. However, the particulates from CFB boiler are mainly irregular, flake-like and floccus-like in shape. The result of eight elements enrichments in fly-ash particles is As>Pb>Cd, Zn>Ni>Co>Cu, Cr. Enrichment quantities of elements fold increase with decreasing of particle size in PC and CWM boilers. The relative enrichment factor of As is 30 and 23 in PC and CWM at the last stage, it of Pb is 16 and 13, and Ni, Co, Cu, Cr have enrichment times of 4-8. While in CFB boiler, there is nearly no enrichment of elements due to low operating temperature.

Keywords: PM10 flashover voltage gradient heavy metals monte-carlo method

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通讯作者: 岳勇

作者简介:

作者Email: yueyong00@mails.tsinghua.edu.cn

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