

Migration and Transformation of Heavy Metals during Thermal Treatment of Solid Waste

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Abstract:

This presentation will introduce the research and progress on the migration and transformation process of heavy metals during thermal treatment of solid waste. It introduces the main research results of two projects: Vaporization kinetics of heavy metals and influence of Ca/Si ratio in municipal solid waste incinerator (MSWI) fly ash with high-chlorine-salt content, supported by NSFC; Development of pilot scale furnace of melting treatment of MSWI fly ash, supported by High-tech Research and Development Program(863).

In the first project: First, the volatilization of chlorides of copper (Cu), lead (Pb), zinc (Zn) and cadmium (Cd) was studied consisting of laboratory experiments and the application of thermodynamic and kinetic theories. The main reaction and the thermodynamic equilibrium proportions of the different Cu, Pb, Zn and Cd species at different temperatures have been calculated. The kinetic models of the volatilization of CuCl_2 , PbCl_2 , ZnCl_2 and CdCl_2 , using the basic theories of kinetics at inconstant temperature.

Secondly, it has outstanding meaning to research the volatilization of heavy metals with different Ca/Si during the thermal treatment process. The paper studied the volatilization of chlorides of heavy metal in stimulant MSWI fly ash and in real MSWI fly ash, in which the Ca/Si was changed by appending CaO or SiO_2 .

Finally, it also investigate the volatilization of three heavy metals Pb, Cd, Cu from MSWI fly ash in high-temperature processes, and to establish the kinetic model of the heavy metal used dynamic isothermal methods.

The adsorption of the gaseous of heavy metals Cu, Cd, Zn and Pb from MSWI fly ash in high-temperature processes was also studied by mixed adsorption system made up liquid and solid, and it also establish the kinetic model of the heavy metal in liquid and solid adsorbent. The speciation distribution of Cu, Ni, Pb, Cd and Zn in fly ash and the particle size effect was researched by a sequential extraction method.

In the second project: the characteristics of heavy metals(Cd, Pb, Zn, Cu, Cr and Ni) were studied during pilot melting process of waste incineration fly ash, and it mainly focused on the solidification of those heavy metals in molten slag. The result shows: Adding 10% glass powder makes the solidification of heavy metals increase greatly except Zn; For Zn, Cu, Cr and Ni, the solidification using air cooling mode is higher than that using water cooling mode.

Keywords:

Heavy metals, MSWI fly ash, Pilot melting, Migration and transformation, Thermodynamics, Kinetics, chlorides, Ca/Si