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Combating Corrosion in WTE Facilities – Theory and Experience

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Abstract

In boilers that use municipal solid wastes as fuel, metal wastage due to corrosion and erosion and tube fouling due to the buildup of deposits present serious problems to the system designer and operator. This study examines the corrosion mechanisms in Waste-To-Energy (WTE) boilers and summarizes the findings of a corrosion survey of several WTE facilities and of interviews with senior engineers in the WTE industry. In addition, this study examines the existing methods of reducing corrosion that are adopted in WTE plants. Finally, the study proposes experimental research on corrosion resistant materials to be carried in the near future.

Introduction

Waste-To-Energy (WTE) technologies produce clean, renewable energy by means of the combustion of Municipal Solid Wastes (MSW). In well designed and operated WTE plants, MSW is combusted and converted to thermal energy that is transferred to steam that generates electricity in a steam turbine. The environmental benefits of WTE technologies include: conserving fossil fuels by generating heat and electricity, reducing the emission of green house gases, recovering ferrous and non-ferrous metals, and reducing the space required by landfills.

A major problem of operating WTE plants is the relatively high rate of corrosion in WTE boilers. High temperature corrosion results in downtime and periodic shutdowns in WTE plants and accounts for a significant fraction of the total operating cost of WTE plants. Aside from the economic aspect, high temperature corrosion also has environmental impacts. Metallic coatings and corrosion resistant alloys such as stainless steels, nickel-base alloys, and titanium alloys are often used to protect boilers from corrosion, and these result in unnecessary use of valuable resources (metals) and energy. Also, corrosion issues hinder further expansion of WTE technology and perpetuate the annual disposal of over 200 million tons of MSW in the U.S. in landfills that contaminate the atmosphere and may affect water resources in the future [1].

Corrosion phenomena in Waste-To-Energy facilities

The advantage of WTE technologies over landfills is that it reduces the environmental burden of disposing solid wastes and also recovers the energy contained in MSW. Over 130 million tons of wastes are combusted annually in over 600 WTE facilities worldwide and the recovered energy is converted to electricity and steam [2]. Figure 1 shows a schematic of a conventional modern WTE facility. The main sections are: entrance zone with weighing facility and refuse receiving area, refuse holding pit and feeding section, the grate and the combustion chamber, combustion chamber integrated with equipment for heat recovery (boiler with water steam system and steam turbine), flue gas treatment system, residue treatment equipment, electrical installation and control system, and auxiliary equipment and buildings.