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Refractory Tile Installation - Mortar or no Mortar?

Patrick M. Stephan
Saint-Gobain Ceramics
1 New Bond Street
Worcester, Massachusetts 01615 USA

Christian His and Nathalie Monchalin
Saint Gobain European Ceramics Research Center
Cavaillon, France

Abstract

Some domestic waste incinerators [1] have operated successfully with refractory tile systems for tube protection without using mortar to bond the tiles to the tube walls. Most tile protection systems installed around the world employ a paste of mortar behind the tiles to develop a rigid fixing system, with the presumption that the mortar provides another layer of tube protection behind the tiles. This paper examines the issues behind these approaches to tube wall protection and propose some guidelines for the use of refractories in these systems.

Introduction

Refractory materials are used on boiler tube walls to protect the tube steel from corrosion, particulate erosion, thermal damage and solid waste abrasion. In waste-to-energy facilities, refractory usage on tube walls is quite varied, ranging from cast aluminum oxide-based cements having low heat transfer capability, to engineered silicon carbide- based cements and special shapes providing higher heat transfer characteristics with longer-term performance and maintenance benefits.

Refractory tube wall protection concepts have evolved over the years with new design concepts and improvements in installation practices around the world. Most state-of-the-art refractory systems now employ silicon carbide gunned, cast or rammed cements or "tile systems", with metal anchors for attachment of tiles to the tube walls.

Conventional engineering in the development of refractory tile systems has dictated that a ceramic mortar, generally consisting of fine silicon carbide grains suspended in a calcium aluminate cement or phosphate chemical matrix, is essential for adhering tiles to boiler tube walls while enhancing heat flow between the tiles and tube walls. Silicon carbide refractory tiles are pressed or cast during manufacturing and fired at high temperatures sufficient to achieve a bonded shape with good mechanical and thermal properties. Mortars are generally mixed with water and are only cured, or fired, to the temperatures they are subjected to in operation on boiler tube walls. Therefore, the heat transfer capability of mortar is lower than that for dense, bonded tile shapes, which indicates that the mortar layer between refractory tiles and tube walls should be as thin as possible to maximize heat transfer [2], yet provide a full contact surface.

Considering the interest of waste-to-energy facility operators to minimize maintenance outage time and reduce maintenance costs, a study was conducted to evaluate a refractory tube wall protection system using tiles without mortar that could be installed quickly and repaired easily. Corrosion protection, heat transfer characteristics and performance over time compared to conventional tile systems using mortar were evaluated.

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