APPLICATIONS OF LOW DENSITY CERAMIC FILTERS FOR GAS CLEANING AT HIGH TEMPERATURES

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ABSTRACT

Low density ceramic filters are now available for incorporation into gas filtration units. Trials have been undertaken with such units on a variety of duties. These duties have mainly concerned the cleaning of gases from high temperature processes prior to their release to atmosphere. Other duties have used high temperature filtration as an integral unit operation, simplifying operating processes.

The paper presents the experiences of the authors with installations in a number of different applications in a variety of industries. The paper discusses the properties and performance of low density ceramic media in general terms and relates these properties to their performance in each of these applications. It identifies specific strengths and weaknesses of this type of medium and proposes projects in other industries which would benefit from the use of this technique.

The paper presents detailed, quantified case studies of the use of low density ceramic media in several industrial processes which are subject to the Environmental Protection Act.

INTRODUCTION

Many industrial processes involve the generation of hot waste gases, which can be contaminated with either solid, liquid or gaseous pollutants. With the advent of the Environmental Protection Act 1990, these processes must now meet tough emission standards for these pollutants. How rigorous these limits are depends on the nature and size of the process. Although the legislation covers a range of airborne pollutants, in practice application of the Act focuses on the removal of the particulate emissions,
ie. the most visible sign of pollution. However, until recently, cleaning up hot gas streams presented considerable problems.

The options available for cleaning a hot gas stream are limited. Essentially, these are bag filter technology incorporating fabric filter media, electrostatic precipitators, wet scrubbers and cyclones. With fabric filters and scrubbers, cooling of the gas stream is essential and maximum efficiency is thus linked to maintaining the gas temperature within a narrow band. This can make the technology sensitive to process upsets such as unexpected temperature surges. Traditional hot gas technology such as ESPs and cyclones are becoming less attractive with the tightening of emission limits under the EPA, which favours the more efficient barrier filtration techniques. With this background, development of hot gas clean up technologies has tended towards producing a barrier type filter, capable of meeting the ever decreasing limits for particulate emissions and free from the restriction of a temperature excursion vulnerability.

Effective and efficient hot gas filtration is now a reality (Seville et al, 1989; Anon, 1991; Withers, 1992) with the availability of several low density ceramic filter products on the UK market and the practical application of low density ceramic filtration in numerous industrial sectors (Anon, 1992; Elliott, 1992). Ceramic candles are available from such companies as BWF, Heimbach, Didier and Cerel. This paper discusses the author's experience with a number of processes incorporating the ceramic filter products of Cerel. While all the data may not be exactly the same for the different products, the problems and benefits encountered will certainly be universal in their occurrence. Frequently, full and open statements of the filter performance cannot be made because to do so would breach customer confidence.

CHARACTERISTICS OF CERAMIC FILTER CANDLES

The standard form of low density ceramic filters is a candle, closed at one end and open at the other. The open end is usually flanged to allow the mounting of the candle on a header plate separating the dirty and clean gas flow. Dirty gas impinges on the outer surface of the candle and clean gas is carried away down the hollow centre of the candle. The particulates are captured on the outer face of the candle and cleaned off with pulses of compressed air which are directed down the centre of the candle, much as in a reverse pulse jet filter. Captured particulates then fall down from the filters and are collected in a hopper.