EVALUATE AND MODEL THE EFFICIENCY OF A BLAST FURNACE GAS CLEANING PLANT USING COMPUTATIONAL FLUID DYNAMICS

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ABSTRACT

Tata Steel Strip Products UK (TSSP UK) has two blast furnaces (no.4 and No.5). Blast furnace operation requires high efficiency top gas cleaning equipment to cope with changes to the top gas composition, dust loading, pressure and temperature fluctuation to match the campaign life of the furnace. Duty of care to the surrounding environment requires that top gas is cleaned to a reasonable level to reduce environmental impact of the iron making process.

TSSP UK currently operates a gravity dust-catcher on blast furnace 4 (BF4). It is the first of the major dust separation and cleaning devices, functioning to remove around 50 - 55 % of the incoming dust from the blast furnace (on a mass in-flow/out-flow basis). Removing as much dust during this primary separation stage enables the processes downstream of the dust-catcher i.e. the wet scrubber and demister, to work more efficiently. The gas is recycled back through the system to provide a major source of energy used to heat the incoming gas to the blast furnace passing through the gas stoves.

The amount of dust present in this recycled gas will affect the efficiency of the burn in the hot blast stoves and lead to ‘sooting up’ of the burners. With studies being carried out by TSSP UK into the incorporation of a top gas recovery turbine on blast furnace 4, and the impending reline of blast furnace 4, the importance of clean, dust free top gas has never been higher.

Gas cyclones are widely used in industry to separate dust from gas or for product recovery, allowing a certain degree of recyclability of process waste. Due to their geometrical simplicity and relatively low power consumption and pressure drop, they may be adapted for use in extreme operating conditions such as high temperatures, high pressures and atmospheres containing corrosive gases. Due to lack of moving parts, cyclones are relatively maintenance free, and have found increasing utility in the field of air pollution, petrochemical and minerals process industries.

Cyclonic separation has been chosen as an alternative to the relative low efficiencies of the gravity dust-catcher, due to the extremely high efficiencies that are possible. Consequently a CFD comparison has been undertaken on two inlet configurations for a specified cyclone for a rebuilt blast furnace in TSSP UK due to be commissioned in late 2012.