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STUDY ON THE EMISSION OF POLLUTANTS ON THE TECHNOLOGICAL FLOW OF FLAT GLASS MANUFACTURING

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Introduction

In the context of today's environmental protection requirements, the glass manufacturing process requires knowledge of the sources of pollution that result throughout the technological flow. The production of glass products is based on various technologies that generate significant amounts of pollutants in emissions. The production of glass products is achieved by going through the following stages of the technological process: dosing of raw materials, homogenization of raw materials, melting and shaping of glass melt, stages that generate pollutants in the environment. The main pollutants emitted from the glass melting furnace are nitrogen oxides and carbon oxides. Nitrogen oxides are the pollutants emitted in the largest quantities. They are formed by the reaction between nitrogen and oxygen at the melting temperature of raw materials. There are two sources of nitrogen that contribute to the formation of oxides: nitrogen in the air and chemically bound nitrogen in burning fuel. In the presence of air NO is unstable and thus, partially oxidises to NO_2 when discharged through the waste gas exhaust stack. In this work, the CO and NOx concentration level was determined as a function of oxygen (reference oxygen 8% according to Best Available Techniques standards). The determinations were carried out both at the melting furnace in the combustion zone and on the waste gas exhaust stack after passing the waste gas effluent through the depollution equipment.

Materials and methods

Measurements were made at a large capacity flat glass melting and manufacturing furnace. Measurements were made on two sides - Side A and Side B in 7 holes CR1-CR7 on each side of the furnace, according to Figure 1. The measurements were made with the automatic analyzer for determining the concentration of pollutants in the gases resulting from combustion, analyzer type TESTO 350 shown in Figure 2.

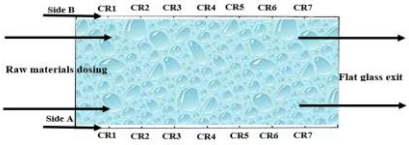


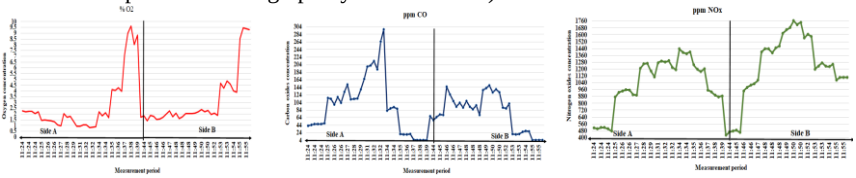
Fig.1. Melting and flat glass furnace

Fig.2. Automatic flue gas analyser

Results and conclusions

Figure 3 a-c represent the evolution in time (measurement period) of the studied pollutants: carbon oxides and nitrogen oxides as well as the oxygen that represents

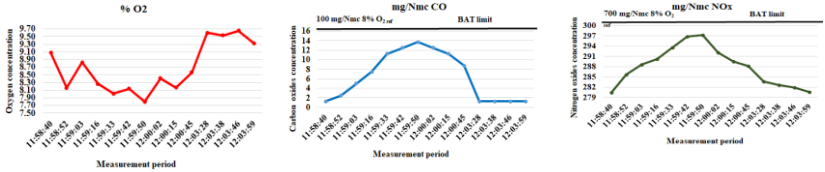
the air supply necessary to burn methane gas and to obtain the optimal melting temperature. The values in the graph represent the measurements made at the openings on the two sides Side A and Side B - CR1-CR7 (the two sides Side A and Side B are separated on the graph by a vertical line).



a b c

Fig.3. Variation of O_2 (a) , CO (b) and NO_x (c) concentration determined on the two sides: Side A and Side B

From the graphs presented, the following can be observed: for the oxygen concentration, the determinations carried out on Side A show low values for the orifices where the measurements were carried out - CR1-CR4 because they are close to the burners and the air-gas jet or flame has a length proportional to the air-gas flow. From CR5 to CR 7 on Side A the oxygen concentration increases as the distance to the burners increases. Similarly on Side B low oxygen values are observed from CR1 to CR5 followed by a significant increase. For carbon monoxide concentration low values are observed at the CR1 measurement orifice then the concentration value is increasing until it reaches a maximum of 297 ppm at CR4 followed by a sharp decrease starting from CR5 to CR7. The same variation of values is observed on the Side B and is due to the measurement site which depends on the distance from the burner. For the concentration of nitrogen oxides the same phenomenon is observed as for carbon oxides. Low values at the first orifice followed by high values up to a maximum of 1437 ppm at CR5 in the case of the Side A. In the case of the Side B measurements higher values were obtained up to a maximum of 1765 ppm at CR4. In conclusion the determinations performed on the two sides of the flat glass melting furnace Side A and Side B show variations for the studied pollutants CO and NOx. The measured values depend on the oxygen level, more precisely on the correlation between the air-methane gas flow and the distance from the burner, which explains the different rise and fall of the concentrations measured on the two sides. Figura 4 a-c represent the variation of O_2, CO and NOx concentration during the measurements. The measurements were carried out after the depollution equipment to check the efficiency of the depollution system.



a b c

Fig. 4. Variation of O_2 (a), CO (b) and NO_x (c) concentration determined after the depollution equipment

There is a decrease in concentration compared to the initially determined values and therefore the measured concentrations are within the BAT limits.