Drying Process of ceramic granulate and its impact to moisture

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Abstract **Paper describes technology of ceramic granulate production which is consequently used for ceramic facings production. Drying is an extensive technological process applied in almost every industry. On of them is ceramic industry. Granulate moisture is one of most important parameters affecting its quality. Paper features measured moisture amounts of granulate and combustion products. The goal of measuring is to find functionality between input parameters and granulate moisture.**

Keywords - **ceramics, granulate, combustion, moisture**

I. INTRODUCTION

Ceramic industry belongs to biggest heat energy consumers from the aspect of power severity. On of technology which use heat is ceramic facings production. Ceramic facings are burnt building materials usually of table shape, with fine-grained and various-colored shatter, compacted under high pressures. The goal is to produce competitive ceramic facings of high quality and demanded dimensions while keeping price in affordable level.

II. TECHNOLOGICAL PRODUCTION PROCEEDING OF CERAMIC GRANULATE

Whole proceeding consist of bringing in stored raw materials (fig.1) according to sequence and amount described in production formula (recipe). In preparation room there are three cabinet feeder located. First two serve for feeding ductile raw into clay grater, other one feeds shortlasting raw into bumping mill. Crushed materials are consequently transported using conveyor belt into diluter which is filled with sufficient amount of water. Propeller is launched in and liquefier is added into the water. For this purpose diaphosphate is used. Its usage is necessary for gaining higher amount of solid in sludge. Finally feldspar, prerubbedd dolomite and colorants are added. Filling of diluter takes an hour, dilution time is 6 hours.

After dilution the sludge is flown down into mixing containers with propeller mixers. Diluted mass is then drawn into grinding cylinders. Percentage contribution of solid and water usually presents 60% of solid and 40% of water. Grounded materials are flown down into homogenizing trunks (pools). From these trunks the material is overdrafted with membrane pump through manifold with permanent magnets into rake mixers located under sprinkle kiln. Sludge drying in sprinkle kiln consist of high pressure jet dispersion into drying tank, where combustion products from natural gas are carried with pressure burner. Sludge dries in tower until moisture of 4,5 to 5,5%. Drying process of ceramic sludge is described in fig 1.

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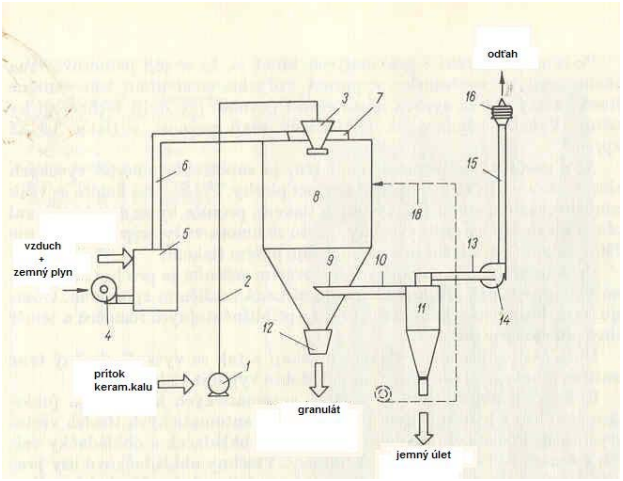

Fig 1 - Sprinkle kiln [1]
1 – pump, 2 – feed pipe, 3 – sprinkler, 4 – ventilator, 5 – combustion chamber, 6 – hot air and exhaust gases pipe, 7 – hot air vane distribution, 8 – kiln tower, 9 – exhaustion, 10 – manifold, 11 – cyclone, 12 – cooler, 13 – cyclone suction, 14 – suction fan, 15 – extract pipe, 16 – air cap

Dried granulate is from bottom part of tower transmitted through vibration screen onto transport belt which gets granulate into each tinny tanks. Compacting mass in tanks is brought to compactors by high-lift cart. Hydraulic compactors are used for pressing. Compacted facing tiles are consequently dried in canal countercurrent kilns with vertical circulation of drying air. Then they are burnt out in electrical canal kilns. Final products are sorted and packed.

III. COMBUSTION PRODUCTS AND GRANULATE MOISTURE MEASUREMENT

One indicator that considerably impact facing tiles quality is moisture of ceramic granulate, which should stay in between 4,4 to 5,5 %. Possibility of reaching demanded granulate moisture depends on few factors, mainly on combustion products temperature and sprinkle jet sizes.

The goal of measurement realized was to find functionality between combustion products moisture after granulate drying, final granulate moisture and combustion products temperature. There is an assumption that these parameters are in some correlation. In case of finding definite functionality between these parameters (or some others which are able to impact combustion process) manipulating of combustion process would be possible after measuring combustion products moisture in order to keep granulate moisture in demanded boundaries.

Measurements were realized at testing kiln tower where granulate samples are prepared. Combustion products moisture was measured in manifold transporting combustion

products out of tower (fig. 1, pos.9). Digital measurement device Testo 645 [3] with automatic value saving was used for measuring combustion products moisture. Besides absolute and relative moisture a temperature of combustion products was recorded. Simultaneously with this measurement the samples of dried granulate were taken in order to determine its moisture. Gravimetric method was used to moisture determination.

Measured records are listed in table 1 and in figures 2 and 3, where functionality of absolute combustion product moisture on granulate moisture or combustion product temperature is represented.

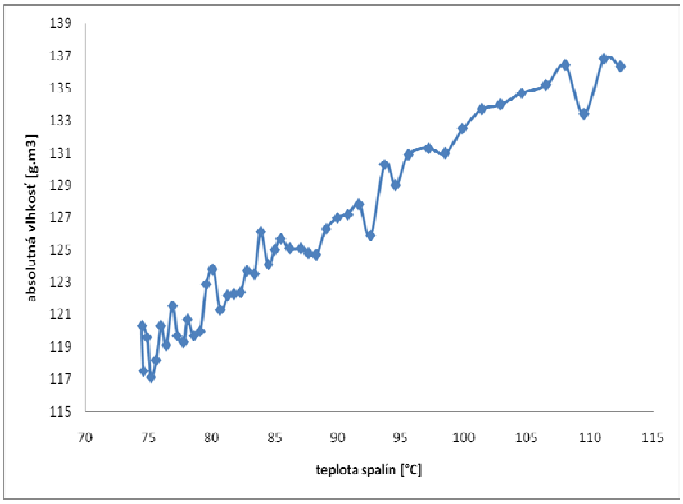

Fig.2 Dependence of absolute combustion product moisture on combustion product temperature

	Combustion temperature [°C]	Relativ combustion moisture [%]	absolut combustion moisture [g/m3]	granulate moisture[%]
Sample #. 1	112,5	14,7	128,9	1,23
Sample #. 2	94,6	26,3	129	6,96
Sample #. 3	84,5	36,2	124,1	8,12
Sample #. 4	79,1	42,8	120	9,31
Sample #. 5	75,2	48,5	117,1	10,77

Tab. 1 Measured records

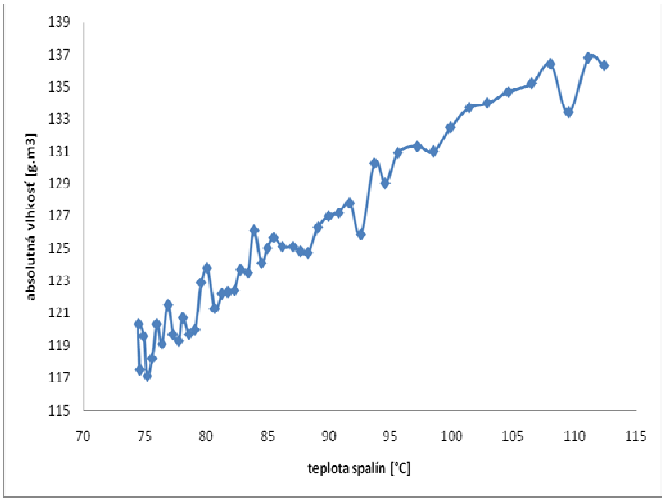

Fig.3 Absolute combustion moisture dependance on the combustion temperature

IV. CONCLUSION

On the base of measured records can be said that combustion product moisture and granulate moisture are affected by combustion product temperature. Decrease of combustion products temperature results in decreasing of absolute combustion products moisture while granulate moisture increases. Increase of combustion product temperature gets more water from granulate into the combustion products. Combustion products moisture depends besides granulate drying rate on amount of water arisen in narural gas combustion (hydrogen burnout). In future there is need to determinate portion of total combustion products moisture fall on combustion process and drying. To do so it will be necessary to identify amount of combustibles needed for drying certain amount of granulate and exact percentage contribution of solid and water in ceramic sludge. Thanks to knowing these facts contribution of combustion products moisture from drying process, or its changes resulting from granulate moisture variations. This knowledge of change sensitivity leads to possibility of controlling and manipulating drying process on the ground of combustion products moisture measurement.

THANKS

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