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Effect of temperature on the volume of gas emissions

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Summary. In the full mould process, the polystyrene pattern which fills the mould cavity is subjected to pouring of this mould with liquid metal to the effect of high temperature (1600 ^{0}C) and passes from the solid state into liquid and gas. During this process some solid and gaseous products of the thermal destruction of the pattern are created. The kinetics of this process depends on the temperature of evaporation and, though to a smaller extent, on the pattern density, which, combined with the mould parameters, parameters of a ceramic coating, i.e. its thickness, permeability, and resistance to the effect of high temperatures, parameters of a granular material filling the mould and parameters of a technological process, including the technique of pouring and design. The mould cavity is filled with a pattern made of foamed polystyrene which on pouring of mould with liquid metal undergoes total destruction.

Key words: Evaporative pattern technology, casting, pattern, pattern made of foamed polystyrene, ferrous alloys

INTRODUCTION

The studies focused on determining the volume of gases emitted from the plastic models and the assumed density. The gasification temperature was the variable parameter. The effect of temperature on the gasification of the material model: the results concerning the volume of emitted gases are presented in graphs [1, 3, 5, 6].

In the full form of the plastic models (polystyrene, copolymer, x models), the model which fills a cavity forms in the course of its filling by the liquid metal and is subjected to the influence of high temperature It passes from the solid through the liquid to the gaseous state. Solid and gaseous products of thermal decomposition of polystyrene patterns are emitted. The kinetics of this process is significantly influenced by the gasification temperature, density and mass of the polystyrene patterns. One of the basic parameters is the amount and rate of gasses from the model polystyrene during its thermal decomposition. To ensure optimal conditions for obtaining a cast of the assumed shape and quality, the main characteristic parameters of the processing need to be worked out, especially the chemical composition and density of the model [8, 10, 11, 13, 14, 15].

TOOL MATERIAL PATTERN

The following materials were selected for the study:

Polistyren (PS) (- [CH2CH (C6H5)] produced by the polymerization of styrene, usually derived from petroleum refining. The models obtained by the thermal expansion of polystyrene in the form of granules in the matrix metal.

DFO studies used models with the density of 20 - 28 kg/m^3

Kopolimer - the type of polymer chains in which there are two or more types of units.

Effect of the density of polystyrene pattern and of evaporation temperature on the kinetics of gas evolution in the full mould process was studied [2, 4, 7, 9, 12, 16, 18].

THE STUDY OF THE KINETICS OF VOLUME OF THE GAS EMITTED FROM THE PLASTIC MODEL

Gases are a regular feature occurring during melting and casting metal into the mould. Their impact on the structure and properties of the cast are dependent on the gas volume in the model, the physicochemical properties of form as well as the amount and form of its occurrence in the metal. If the gases are emitted in metals in amounts exceeding their natural solubility under given conditions (often at lower temperatures), they reduce the quality of the casting, and often contribute to the formation of defects such as gas bubbles, puncture. The formation of these defects is determined not only

by quantity but also the kinetics of release of gases (eg, core pattern). Metal is in contact with the gases at all stages of the technological process (gassed feed material, the atmosphere in the process of melting and pouring metal into contact with the form and the core model) [17, 19, 20, 22, 24].

In this research studies focused on the determination of the volume of gases emitted from a selected plastic form.

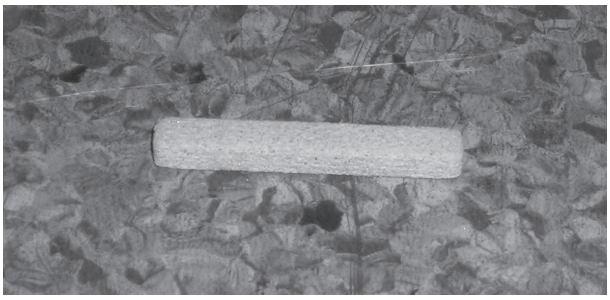

Fig. 1. Research pattern

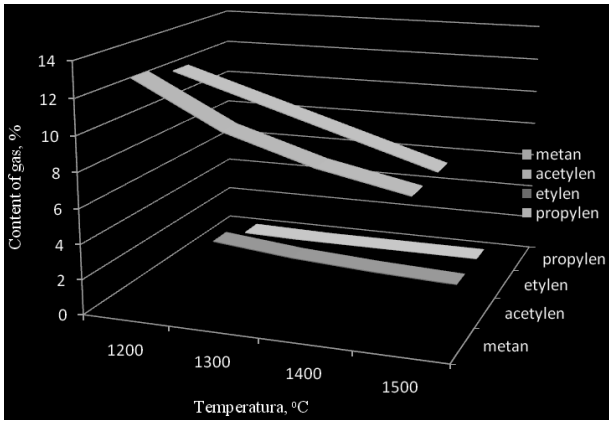

Fig. 2. The contents of selected gases in the polystyrene form in the temperature range 1200 to 1500°C, measured by the chromatograph

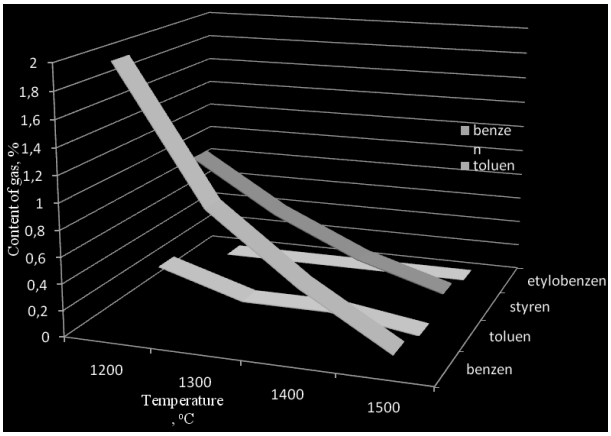

Fig. 3. The contents of selected gases in of the polystyrene pattern in the temperature range 1200 to 1500°C, measured by the chromatograph

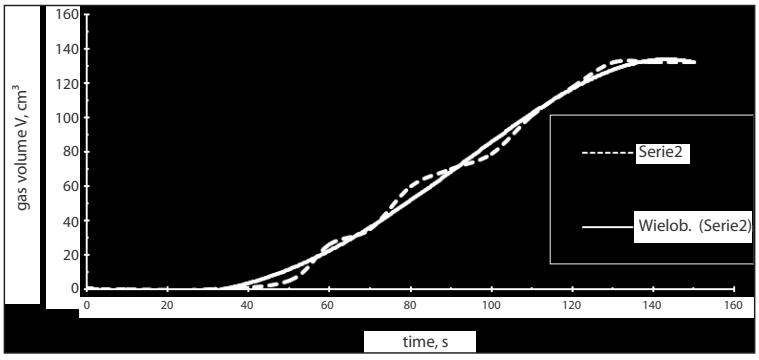

Fig. 4. Gas volume emitted from 1 g of the polystyrene pattern of 28 kg/m^3 density at the temperature of 600°C in function of time

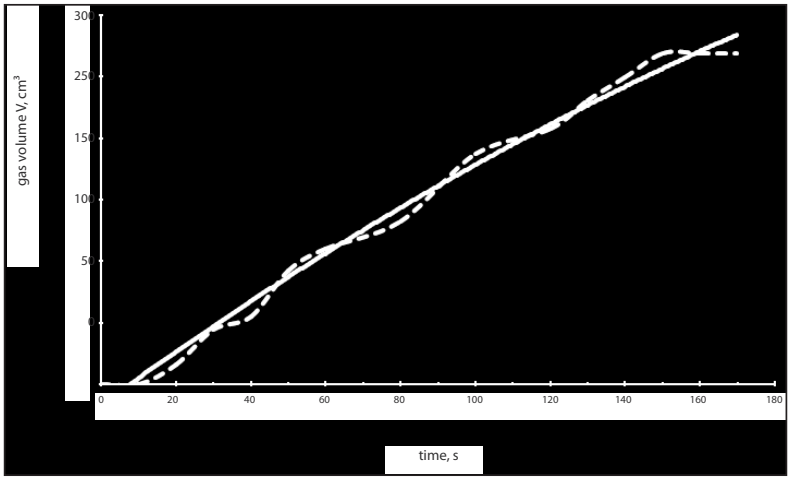

Fig. 5. Gas volume emitted from 1 g of the X pattern at the temperature of 700°C in function of time

RESULTS AND DISCUSSION

After examination of the volume of gas emitted from of the tested materials it was found out that the temperature of 600 °C occurs uniformly at the gasification process. And it ends when the model PS 120s and 70s are in the model X [21, 23, 25, 26].

Increased volume of gas spun from polystyrene model was found: the research has shown the volume of separated gases is greater than the volume of gas separated from the model X.

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