

Abstract

The used organic substances, mainly synthetic resins, as binders for molding and core sands adversely affect the condition of the environment and working conditions in the foundry. In recent years, the Alphasbet technology based on resole phenol-formaldehyde resin is considered one of the most environmentally friendly mass-binder technologies. Moreover, its advantage is also the fact that it doesn't contain nitrogen, sulfur or phosphorus compounds and therefore it can be used both for the production of cast steel and ductile cast iron.

The project presents the results of research on thermal decomposition of three commercial binders used in Alphasbet technology from three different manufacturers. The research was aimed at assessing the harmfulness of this technology in the whole process of casting from the moment of pouring the mold into liquid metal to extract the mold casting. The research was carried out using modern coupled methods to reproduce the metallurgical and casting phenomena occurring in the cavity during casting. The Py-GC/MS technique is a helpful method in identifying thermal decomposition products of organic binders used for molding and cores. The ability to regulate pyrolysis temperature allows modeling of processes taking place directly at the liquid metal/sand boundary (so-called flash pyrolysis). In order to present the processes occurring in the depth of the mold, as a result of transporting the heat flow from the casting, the TG/DTG/DSC-FTIR system was used, which allowed to identify individual substances and to explain some phenomena occurring under the influence of high temperature. The composition of solid residue from binder after heating at 600°C was also tested. The study showed that the identified type of compounds depends on the type of used resin, depends also of the temperature and the atmosphere in the form. The binder degradation process is different than the same resin, which is the result of additives used by manufacturers to improve the technological properties. The presented results form part of a wider research in the field of thermal destruction of commercial binders used to make foundry molds and cores, in order to determine their harmfulness to the environment and human.

Obtained results may be useful for foundries in the area of defects in castings and helpful for relevant services dealing with environmental and work conditions testing in assessing the negative impact of a binder. The paper presents diagrams of the course of thermal degradation of the Alphasbet binder depending on the temperature and type of atmosphere.