

## Eco-Friendly Casting By Using Innovative Inorganic Binder Systems (IIBs)

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**Abstract:** The article presents the gas emissions results, released during thermal destruction of molding sands with innovative inorganic binder systems (IIBs). These studies were conducted in terms of assessing the harmfulness of these molding sands based on the emissions of compounds such as benzene, toluene, ethylbenzene, xylenes, polycyclic aromatic hydrocarbons, phenol, formaldehyde and others. Moreover, equally important factors studied from the technological point of view were volume of released gases and the gas release rate. It has been shown that the use of innovative inorganic binder systems (IIBs) in molding sands significantly reduce emissions of harmful substances generated during the casting process compared to organic binder systems. These studies were conducted as part of a European Green Casting Life project (LIFE21 ENV/FI/101074439) [1].

**Keywords:** green casting; BTEX; PAHs emissions; dust; harmful substances; clean production; new inorganic binders; sustainable development.

### 1 Introduction

European foundries mainly use sands with bentonite (green sand) and sands with organic binders (e.g. no-bake) to produce molds and cores. Only 1% of foundries in Europe use technologies based on inorganic binder systems [2]. The main reason for this situation is technological limitations. When choosing a technology for the production of molds and cores, the following elements should be taken into accounts: efficiency, casting quality and impact on the environment and working conditions, which consequently determines the costs [2]. The advantages of technologies using organic binders are: small resin addition, high reactivity and low binder viscosity, high strength and good reclaimability of molding sands [2]. Their disadvantage is the emission of numerous compounds, including harmful ones (e.g. formaldehyde, phenol, benzene and their derivatives and sulfur compounds), generated during pouring, cooling and knocking out molds. In addition, the high price of components eg. furfuryl alcohol, nitrogen content in furfuryl resins (unfavorable for steel castings) etc.

### 2 Conclusions

It has been shown that inorganic innovative binder systems (IIBs) significantly contribute to reducing emissions of hazardous compounds (Fig. 1) and improving working conditions compared to organic binder systems [1].

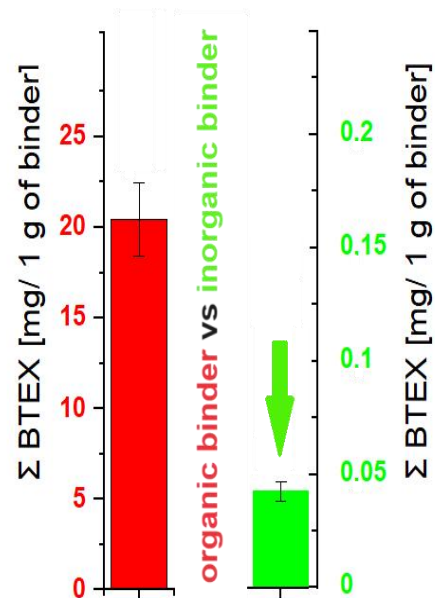


Fig. 1 Exemplary results of BTEX content in emitted gases from molding sands with organic and innovative inorganic binder system (IIBs).

Moreover, replacing organic binders with inorganic binders can potentially expand the possibility of managing used moldings and thus contribute to reducing the amount of waste, which is also consistent with the circular economy. The introduction of innovative inorganic binder systems (IIBs) in the foundry industry is consistent with the sustainable development strategy and will have a positive impact on the development of this industry. This means it is necessary to take into accounts the interdependence between the environment and socio-economic aspects when making strategic decisions and production activities [1,2].

### Acknowledgments

The research is financed within GREEN CASTING LIFE project. GREEN CASTING LIFE project is co-funded by European Union's LIFE program under grant agreement LIFE21-ENV-FI101074439. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the



European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them. GREEN CASTING LIFE project (LIFE21-ENV-FI-101074439) is co-funded by the National Fund for Environmental Protection and Water Management (NFOŚiGW) under grant agreement 276/2023/Wn-06/OZ-PO-LF/D.

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