

How aerogel additives can significantly improve the casting process in foundry applications

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Abstract

Cavities in castings of metals and alloys are obtained by so-called cores, which are made of polymeric-bonded sands. Special additives are used to overcome negative effects that cause a lot of casting defects. Organic resorcinol-formaldehyde (RF) or inorganic carbon aerogel in granular form can replace conventional additives without any effort in the foundry process and offer a variety of advantages due to their nanostructure and composition.

We established a synthesis of these aerogel additives for iron casting, transferring the production from laboratory to pilot plant scale, elevating the level of development with respect to foundry needs. Our approach yields about 15 kilogram of RF aerogel in one batch. Further processing includes coarse milling, screening and carbonization of the organic aerogel to amorphous, nanostructured, highly porous carbon with special features. Practical applicability of the additives has been tested and examined in a demanding case of iron casting.



Fig 1. Impressions from the core molding and iron casting. (picture credits: Bosch Rexroth AG)

We were able to identify some very positive effects of the aerogel additive to the casting process compared to the regular used additive: higher core strength, delayed evolution of gas due to decomposition of the binder, significant reduction of gas emissions (BTXE, phenol, formaldehyde), smooth surface (Fig. 1). Additionally, the results show, that a considerable improvement of energy efficiency at different stages of the foundry process can be achieved by the application of aerogel additives.

References

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