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Effect of binder type on properties of molding sands dedicated to 3D printing

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Abstract - The production of thin-walled iron casting with complex shape, characterized by high quality while maintaining the required properties, involves many steps in the production process. One of them is the appropriate selection of the technology of molding and core sands, taking into account strict environmental requirements.
3D printing technologies are classified as innovative additive production methods. In the production of foundry molds and cores, the binder jetting technology is used. It is a modern technology that enables the production of molds and cores with shapes and layout impossible to obtain using traditional molding methods. The method involves binding layers of sand grains (with or without hardener) together using binders and/or other agents.
3D sand printing technology mainly uses quartz sand with a grain size of 0.14-0.25 mm as a matrix. The binders used are resins, mainly furfuryl alcohol modified resins bonded in no-bake technology. Environmentally friendly inorganic binders are rarely used for molds and cores production using binder jetting technology.
This paper will present the influence of binder type on the properties of molding sands, including sands dedicated to 3D printing. Based on studies of commercial resins intended for molding and core production by traditional methods and in 3D printing technology, the authors will demonstrate the possibility of replacing environmentally harmful organic binders with inorganic binders. Various technologies for binding molding compounds will be presented, including chemical, thermal (also microwave) or combined binding. The effects of different binders on the strength, permeability, abrasion of the tested sands will be presented, as well as their influence on the kinetics of binding or thermal deformation.

Key words: innovative technologies, 3D sand printing, molding sand, resin, inorganic binder

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