Local microwave heating of sand molds as a means to overcome design limitations in sand mold casting

Abstract:
Microwave induced selective heating outmatches conventional mold heating by convective heat transfer in means of energy efficiency and cycle time. Moreover, it provides the opportunity of a local manipulation of solidification and cooling processes within the sand casting mold. In this paper, we investigate the suitability of different highly absorbing materials to indirectly heat up the mostly microwave transparent sand mold. The temperature-dependent permittivity of the involved materials is determined by resonator experiments and subsequently used to simulate the electromagnetic field and the thermodynamic response of the sand mold prior to a metal casting process. Experimental results are presented and compared with the outcome of the coupled electromagnetic-thermodynamic simulations and the influence of local microwave heating on the solidification and cooling of the cast is studied.