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Effect of molding sand constituents on casting quality: an RSM-based study

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ABSTRACT

The casting process is a fundamental manufacturing method used for producing complex metal components with varying geometries and applications. However, the quality and efficiency of cast products are significantly influenced by multiple process parameters such as moisture percentage, clay percentage, silica oxide (SiO_2) percentage etc. This study focuses on the experimental investigation and optimization of key casting process parameters using the Response Surface Methodology (RSM) & Statistical Analysis (ANOVA), a powerful statistical tool for modeling and analyzing problems where several variables influence the output responses. A series of experiments were conducted to understand the influence of selected parameters on critical output responses such as surface finish, dimensional accuracy and mechanical properties of the cast product. The collected data was used to develop regression models and generate response surface and contour plots. The interaction effects between process parameters were analyzed to identify optimal conditions that yield the best performance. The results indicate that the most significant factor affecting surface finish of the cast product is clay percentage and next important factor in this respect is moisture percentage followed by SiO_2.

Keywords: Casting, RSM, ANOVA, Surface Finish, Mechanical Properties