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Temperature prediction model in an electric arc furnace based on data-driven

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Accurate prediction of molten steel temperature in electric arc furnaces plays a crucial role in optimizing steelmaking processes. However, the EAF smelting process is characterized by strong nonlinearity, complex multivariable coupling, and significant uncertainty, which pose substantial challenges to conventional mechanism-based temperature models.

To address these challenges, a data-driven temperature prediction model in an electric arc furnace is proposed. A comprehensive dataset collected from an operating EAF is first preprocessed to remove noise and outliers. Key process variables affecting temperature evolution are identified through correlation analysis and feature selection techniques, including scrap amount, pig iron amount, lime amount, oxygen consumption, total power consumption, melting duration. These variables are used as inputs of temperature prediction models.

Several machine learning algorithms, including artificial neural networks, support vector regression, and ensemble learning methods, are developed and systematically compared to evaluate their prediction performance. The models are trained and validated using actual plant data, and their effectiveness is quantitatively assessed using standard statistical metrics such as mean absolute error, root mean square error, and the hit rate.

The results demonstrate that the data-driven models can effectively learn the complex mapping between process parameters and molten steel temperature, achieving higher prediction accuracy. The proposed approach offers a feasible and scalable solution for intelligent temperature management in electric arc furnace steelmaking and provides a valuable reference for the development of smart manufacturing in the steel industry.

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