THE PROBLEM

The campaign life of a blast furnace is highly dependent on residual thickness of refractory lining in the hearth. The progress of hearth lining erosion is greatly affected by hot metal flow patterns and heat transfer in refractory under different operating conditions. Thus it is of great importance to monitor the hearth erosion and adjust operating conditions accordingly to prevent further erosion. The difficulty of measurement in the hearth makes computational fluid dynamics (CFD) modeling more feasible in hearth erosion prediction.

THE PROJECT

A 3-D comprehensive CFD model has been developed specifically for simulating the blast furnace hearth. It includes both the hot metal flow and conjugate heat transfer through the refractories. The model has been extensively validated using measurement data from industry blast furnace. Good agreements between measured and calculated refractory temperature profiles have been achieved. The virtual reality (VR) visualization technology has been used to analyze the velocity and temperature distributions and wear patterns of different furnaces and operating conditions.

THE OUTCOME

The CFD model has been applied to predict the hearth inner profiles of the actual blast furnace and understand the effects of operation conditions. The results can be used to predict the inner profile of hearth and to provide guidance for protecting the hearth.