Design Analysis
Ladles and BOF Vessels

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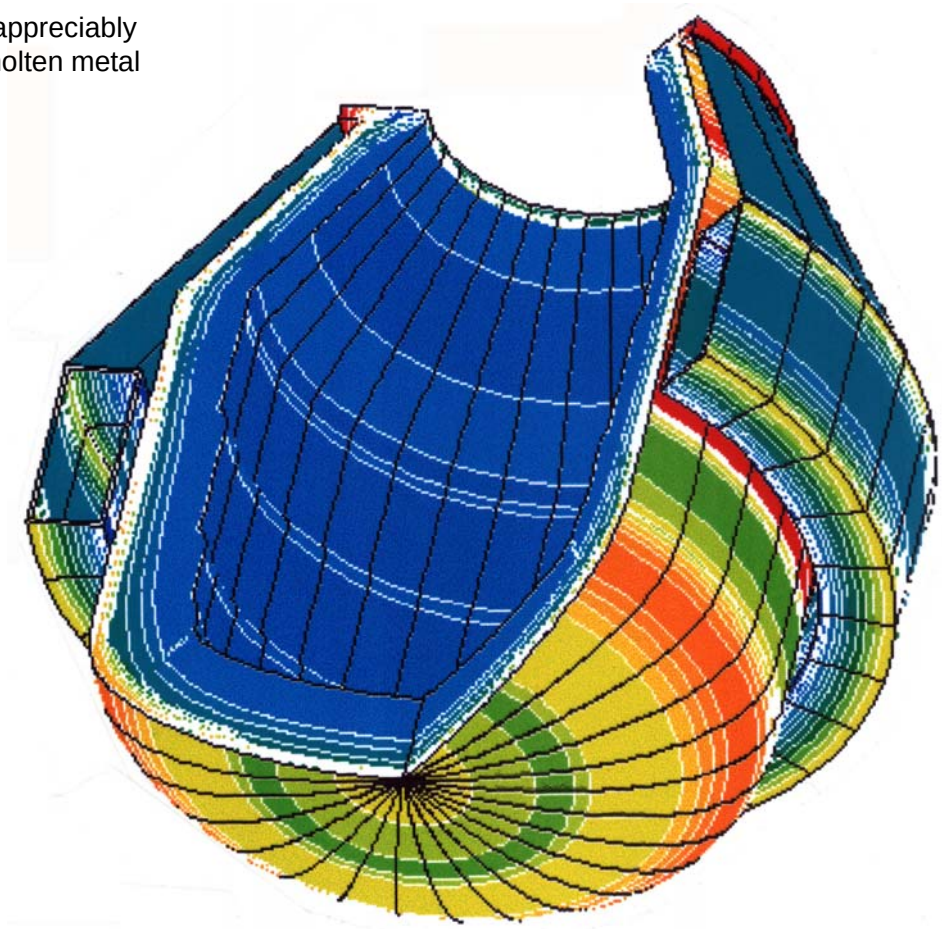
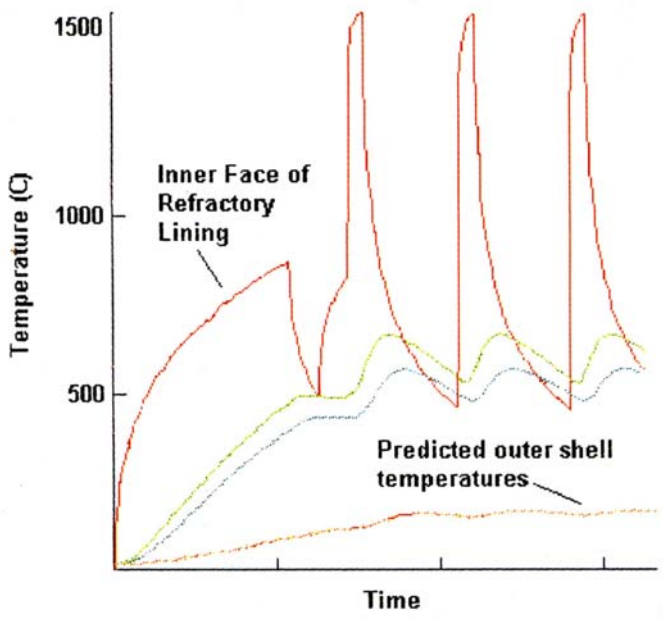
New steelmaking practices have appreciably increased the residence time of molten metal within steel containing vessels. This, coupled with the use of high conductivity refractory materials, has produced more severe thermal loads on Ladles and BOF Vessels and hence the need for improved design.

Finite element methods are used extensively in the design and analysis of Ladles and BOF Vessels to predict temperatures, stresses, and displacements for a variety of load conditions.

A typical operating cycle for a Vessel consists of the preheat / drying phase and repeated Periods when they are filled and emptied of molten metal. The temperature distribution through the refractory lining and the outer steel shell varies through this operating cycle.



PREDICTED STRESSES IN THE REFRACTORY AND SHELL OF LLANWERN BOF VESSEL



PREDICTED LADLE LINING TEMPERATURES

Using finite elements the changes in temperature are simulated. From these, stresses in the shell and lining are calculated by assessment against design codes.

There are many benefits of using design analysis for ladles and BOF vessels:-

- Security of operation
- Provides an approved structure
- Avoids risk of cracking and plastic deformation (account is taken of differing refractories, testwork to establish reactions of refractories is also included)
- Extended life of body of ladle (no limits as yet established)