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Strip Casting:

Anticipating New Routes to Steel Sheet

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Executive Summary

This project had two goals: (1) to determine the potential for strip casting in the steel industry and, (2) to develop the fundamental knowledge necessary to allow the role of strip casting in the modern steel industry to be understood.

Strip cast low carbon steels are quite unique due to the more rapid processing conditions that occur during twin roll casting. There is a potential for castings produced by this technique to be significantly better in surface, shape, profile and internal quality than any other current casting process. This direct casting process is also the first casting process where the cast surface directly becomes the product surface and the process must produce a casting that is equivalent in geometry to a hot rolled material. This makes the process a combination of a casting and a rolling process.

As the twin roll direct casting process does not mimic the thermo-mechanical processing that a slab encounters in conventional processing, it should be of no surprise that the properties that are encountered in twin roll cast product are substantially different than that of conventionally processed material. It is however noteworthy that strip cast material is amenable to thermo-mechanical processing and combinations of heat treatment and cold reduction can lead to a wide variety in properties from a single chemistry. However, the initial results of this work suggest that the properties that can be achieved by strip casting from a given grade are not necessarily equivalent to that which can be achieved by conventional processing of the same chemistry. Significant thermal control during casting and coiling and subsequent thermo-mechanical processing will be necessary for strip cast material in order to control properties as the material properties are sensitive to thermal cycling. In addition, to allow conventional properties to be achieved in low carbon steels products, many grade chemistry adjustments will probably be necessary. This will prevent strip cast material from being transparent in the marketplace.

This work has not found any issue that is a major problem with the technology of strip casting. Strip casting of carbon steels is technically feasible for sheet material from slightly less than 1 mm thick to 3 mm thick, and, assuming that it is economically viable, it will be first applied in carbon steel markets that do not require stringent surface quality or extensive forming. The more rapidly solidified structure of direct cast strip tends to be strong with low ductility; however, with adequate thermal treatment, it is possible to develop a variety of properties from the same grade. The process is more amenable at this time to production tonnages per year of the order of 500, 000 tons and as such will first find niche type applications. This technology is an additional technology for steel production and will be in addition to than a replacement for current casting machines.

It is clear that strip casting is not at this time developed to the point that application of the technology is risk-free. There is great potential for strip casting; in fact, this work points out that the potential of strip cast material is to be better than that produced by current technologies. However, many basic questions remain unanswered and there are significant technological questions to be answered in the area of thermo-mechanical processing