Billet Straightness

Question

We manufacture a range of medium-carbon alloyed steels by oil-cast and powder-cast methods. All billets are cast in triple tapered; curved molds. When oil-casting these grades the billets are very straight. However when powder-casting the same grades for special applications, the billets are "wavy" in two planes and can be unacceptable for the Bar Mill. Billets exit the secondary spray chamber with intermittent hot and then cold corners. Can you please explain what is causing this and what strategies we canfollow to solve the problem.

S.M.G., Australia

Answer

The intermittent hot and cold corners point to uneven heat transfer in the mold. As a first examination take macroetch tests in both the hot and cold regions to determine if the chill zone formed in the mold has a uniform thickness particularly in the corners. On a comparative basis, the hotter corners should have a thinner chill zone as compared to the colder corners.

Make sure the submerged entry nozzle is centered in the mold. Steel stream directionality in the submerged entry nozzle can occur due to clogging or slide gate hole alignment. This could cause hotter steel to preferentially migrate to one mold wall surface. Usually mold powder reduces the heat transfer rate to the mold cooling water as compared to oil lubrication unless there is non uniform melting or coverage of the newly formed billet surface. Close work with a mold powder manufacturer may be needed to adjust the mold heat transfer characteristics to accommodate stream directionality or minor submerged entry nozzle misalignment. Adjust the mold level up and down and likewise the submerged entry nozzle immersion depth to determine the effect on the problem. Determine if you need to adjust for a different negative strip time for powder casting as opposed to oil lubrication.

The triple taper mold may not be needed for powder cast billets. If your company has a single taper mold, perhaps 0.6% taper, try it with mold powder and determine the effect on billet straightness. If you only have triple taper molds experiment with a worn but not gouged mold.

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If the solution is not found in the mold, perhaps some mold powder slag is intermittently blocking the spray nozzles just below the mold. Asymmetrical spray cooling can draw the billet in one direction or another.

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