

Latest Developments for Hardspot Inspection on heavy plates

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Hard Spots are local areas with increased hardness on the surface of semi-finished or end products in steel manufacturing. The cause of these hard spots is attributed to effects in the casting or rolling process. In general the occurrence of hard spots cannot be avoided completely in production of heavy plates. Therefore, in various current line-pipe specifications the topic 'hard spots' is discussed and there is actually a strong request for a suitable test method from end users as well as manufacturers of line pipes. The current presentation should give an update on the ongoing developments. Basis of all current approaches are electromagnetic inspection methods, based on the correspondence in between electrical and magnetic material properties and physical hardness. To be able to integrate an inspection into the production process, the so called rolling skin or mill scale, a thin surface layer of different iron oxides with different material properties to the base material, should not influence the inspection results. The inhomogeneities of this rolling skin, especially in conductivity and permeability, normally render standard eddy current inspection impossible. Additionally in the standard production process, the products were handled by large cranes, manipulating the plates by strong magnets. These magnets leave behind a significant residual magnetization. To overcome both problems the method uses a strong alternating multi-frequent magnetization to measure different resulting micro magnetic parameters. By combining these parameters, the mill scale as well as the residual magnetization effects can be minimized, so it gets possible to measure even small local hardness variations on the plates. The presented paper describes the actual progress of the inspection method itself including the theoretical background as well as the calibration on artificial hard spots and the applied inspection procedure. Furthermore an outlook will be given to the implementation in an automatic inline inspection system for plate mills.