DETECTION OF RESIDUAL CURVATURE IN ELECTRICAL STEEL STRIP USING A MAGNETIC FLUX INJECTION TECHNIQUE

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A novel magnetic technique has been developed to assess the residual curvature in non-oriented electrical steel strip in the semi-processed condition. The technique is based on differences found in apparent values of the total loss from measurements made on opposite surfaces of strip material using a single yoke, flux injection type of magnetisation system. The single yoke consists of primary and secondary electrical windings wound onto a laminated, soft magnetic C-shaped core. This yoke is placed on, or near, the surface of the strip material (which is held flat) with losses associated with opposing surfaces of the strip assessed in turn. The differences in values of loss measured with the energised yoke placed on each surface have been found to be dependent on the degree of residual curvature held within the strip material. Various parameters have been assessed to optimise the sensitivity. These include the selected peak flux density, frequency of magnetisation and the physical characteristics of the magnetising yoke. Differences in loss between surfaces are also found to be dependent on strip thickness and applied tension. The technique is not strongly dependent on the gap between the yoke faces and the strip surface as loss, rather than permeability, is used as the key parameter. Total loss is not strongly dependent on the inclusion of an air gap in the magnetic circuit. This being so, the technique lends itself to having good potential to be developed as a practical method for the non-destructive evaluation of residual curvature in strip steel.