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BIREFRINGENCE AND POISSON'S RATIO DETERMINED BY ULTRASOUND: TOOLS TO FOLLOW-UP DEFORMATION BY COLD ROLLING AND RECRYSTALLIZATION

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Since cold rolling of a metal plate induces a degree of orthotropy that can be reversed by a recrystallization heat treatment, it is proposed the use of Poisson's ratio and birefringence, both measured by ultrasound, to follow the evolution of the anisotropy in ASTM A-36 steel plates cold-rolled to various degrees of deformation and then subjected to recrystallization. Cold rolling between 5 and 50% deformation and heat treatments at 900 and 1000 oC were performed. Normal incidence longitudinal and shear wave transducers in pulse-echo mode were used to measure times of flight along the thickness of the plates. Results show that the greater degree of orthotropy associated to the increased degree of deformation, increases birefringence and also the difference between Poisson's ratios measured using a shear wave polarized along the length and another wave polarized along the width of the plate, from an initial difference of 0.0007, to a difference of 0.0213 at 49.7% deformation. These changes allow to establish linear relations between Poisson's ratio, birefringence, degree of deformation, and cold-rolled hardness. On the other hand, the ultrasonic methods used clearly detected the complex changes in texture produced by the austenization heat treatments. In conclusion, Birefringence or Poisson's ratio, measured by ultrasound, can be used to follow-up non destructively changes in the anisotropy of rolled plates as a function of both, degree of deformation and heat treatment.