

## Effect of single pass friction stir processing on magnetic properties of steel

Mohd. Zaheer Khan Yusufzai<sup>1\*</sup>, Sanjay Kumar Gupta<sup>1</sup>, Mithlesh Kumar Mahto<sup>1</sup>, Avinash Ravi Raja<sup>1</sup> and M. Vashista<sup>1</sup>

<sup>1</sup>*Department of Mechanical Engineering  
Indian Institute of Technology (BHU)  
Varanasi 221005, U.P., India*

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\*e-mail: [mzkhan.mec@iitbhu.ac.in](mailto:mzkhan.mec@iitbhu.ac.in)

Micro-magnetic response upon friction stir processing of IS 2062 steel plates was studied in form of hysteresis loop characteristics (such as permeability, coercivity, core loss). The magnetizing parameters; applied magnetic field, excitation frequency were varied in wide range to observe their effect on magnetic response of material. Magnetic field was applied using sinusoidal waveform and triangular waveform over base metal and friction stir processed sample for comparative analysis. Rectangular sample of 3 mm thickness were processed using tungsten carbide tool having 15 mm shoulder diameter at 800 RPM and 150 mm/minute welding speed. Micro-hardness testing and metallographic study of friction stir processed sample were also performed to study the effect of friction stir processing on material properties as well on magnetic response of processed material. Grain refinement upon friction stir

processing changed the microhardness of processed region. Friction stir processing led to increase in hardness of processed sample in comparison to the base metal due to combined effect of plastic flow of metal during stirring action of rotating tool and frictional heat which also resulted in grain refinement. Metallographic analysis and micro-hardness testing results showed good correlation with magnetic response of base plated and friction stir processed plate. Variation in applied magnetic field and excitation frequency not only changed the shape of hysteresis loop but also resulted into wide variation in hysteresis loop characteristics such as permeability, remnence, and core loss. Magnetic response of base metal and processed sample with change in waveform of applied magnetic field was not as much affected as was observed with variation in magnetic field strength and excitation frequency.