Ternary phase soft magnetic coating on grain oriented electrical steel

Sreedhara Sarma, Hannah Noorizadeh and **Fiona Robinson**
Tata Steel Europe Warwick Technology Centre, UK

Looking at the power loss from transformer cores it accounts for approximately 5% of energy efficiency. In the European Union, there is an estimated 100 billion kWh total energy loss from transformers, which correlates to 40 million tons of CO2. In addition to this, some part of the energy is lost as transformer humming noise, which is a direct effect of magnetostriction phenomenon in grain oriented electrical steel (GOES). The loss could be reduced by improving the secondary recrystallization methods, grain orientation control, increasing the electrical resistivity of the steel, reducing the thickness of laminations and manipulating the domain structure. Applying coatings to GOES can also reduce the power loss by providing electrical resistance, improving magnetic permeability or the surface roughness as well as applying beneficial tensile stress. In order to improve the power loss, the coating selected must have a higher magnetic permeability and resistivity than GOES in order to reduce the power loss in this way. Aligned to the ternary phase metal alloy coatings were developed and applied to GOES through electroless and electroplating methods. The ternary phase coating applied on GOES improved the magnetic properties by applying beneficial tensile stress, which aligns the domains in the direction of magnetization and reduces the magnetostriction. There was also an improvement in the surface roughness, which reduces the number of pinning sites on the surface of steel.

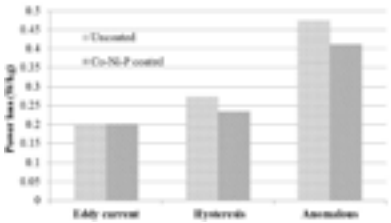

Figure 1: Loss separation at 1.5 T magnetic flux density and 50 Hz frequency for the Co-Ni-P coated sample at pH 9.

Biography

Sreedhara Sarma has completed his master's degree from Loughborough University in 2008 and PhD at the age of 30 from the School of Engineering & Informatics, University of Bradford. He is a Project leader & Principal Researcher in R&D at Tata Steel, a premier steel manufacturing company. He has published papers in reputed journals along with three international patents in the relevant area of research.

Sreedhara.Sarma@tatasteel.com

Notes: