

Grain Oriented Electrical Steel, a smart asset for energy change management

T. Belgrand¹

¹*thyssenkrupp Electrical Steel, BP23, 62330 Isbergues France*

In 1933, Norman Goss filled the first patent describing how to obtain a highly anisotropic electrical steel (GOES) which was to move upside-down the whole transformer world. Offering from the start much lower losses than the so far used electrical steels, this 86' material is still today the most valuable one to cope with the ever challenging situation of environmental concerns in the field of production, transport and distribution of electric energy. Although the metallurgical principle to achieve such performing steel is among the most complex ones, a very simple recipe did build its success and durability: a basic alloy composition of 97% iron and roughly 3% Silicon in shared weight combined with metallurgical routes of the classical, well experienced, reliable and productive tools of the steel industry. After decades of continuous improvement, two main events made recently GOES endeavour even further to show its capacity to stand the spot in energy saving environment, 1) Ecodesign directive enforced by European Commission since July 2015 driven by the need for a drastic reduction of CO2 emission and 2) the push forward of the power electronic industry. This latter one now offers components able to switch very high voltages and current in the medium frequency range for the manufacturing of efficient static converters. Those are dedicated at the growing needs of the renewable energy industry for the management of reversible energy flows. In this case DC grids are more and more thought of with converters working in the kHz range. Some development have been made by various institutes to integrate GOES inside Solid State Transformer (SST) cores even with using the ability of the steel to be operated a high temperatures. GOES industry faced all these changes by developing new grades of reduced thickness through accurate metallurgical processes leading to lower specific loss with excellent magnetising ability. Standards have, too, adapted to this evolution in terms of whether product performance or measurement technique of electrical steel properties. Although its basic structure is well known, some of its features need still to be better understood and described for utmost improvement of the end application. Transformer / converter industry may take advantage of it as well as e-mobility sector for some special motors of very high efficiency are built around GOES cores. This presentation intends to show the specificity of GOES and all the changes that occurred in its properties leading to some successful use cases which will be shown.