Direct observation of the influence of grain orientation on the corrosion of steels

Tonye Jack*[1] and Jerzy Szpunar[1]

[1]University of Saskatchewan [Saskatoon] – Canada

Abstract

The aim of this study is to establish a correlation between the crystallographic texture of steels and their resistance to corrosion. Electron backscatter diffraction (EBSD) was used to investigate the direct impact of grain orientation on the corrosion behavior of steels in different corrosive environments. The corrosion behavior of steels is known to be dependent on several microstructural features, such as their phase composition, grain boundary character, local misorientation, dislocation density, and crystallographic texture, among others. It is noteworthy that the individual effects of these microstructural characteristics may differ in diverse corrosive conditions, such as those arising from variations in electrolyte pH and temperature. To systematically examine the influence of specific grain orientations on corrosion resistance, the steel samples were subjected to planned thermomechanical treatments. The experimental methodology involved exposing these treated steel samples to controlled corrosion environments and mapping the morphological changes of the microstructure at pre-designated locations using EBSD and scanning electron microscopy. Preliminary results show distinct corrosion responses associated with specific grain orientations, with the low-index planes clearly displaying different behavior in the selected corrosive environments. The findings from this study would contribute to a better understanding of corrosion at a microstructural level, providing valuable insight on the relationship between surface crystallographic texture and corrosion susceptibility of steels.

Keywords: Steel, Crystallographic orientation, Microstructure, Corrosion, Electron backscatter diffraction

*Speaker