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Online Temperature and Deformation Measurement for Vessel Shell of Oxygen Steelmaking Converters

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Information regarding temperature and deformation of the converter shell, particularly the barrel section and top cone, help predict remaining lifetime of top cone, detect damages in refractory, etc. Since the trunnion ring obscures much of the view on the converter, thermal cameras do not provide this information. Hence, sensors have to be arranged directly on the vessel shell. Unfortunately, the high temperature environment disallows the use of electronics, given their maximum working temperature of 80 $^{\circ}$ C.

In 2019 Danieli Corus developed an online temperature measurement system and the first field tests were done with voestalpine Stahl GmbH in Linz. At first, three temperature measuring elements (Q-Temp 2.0) were installed on converter #9 inside the trunnion ring. After some optimization, these are providing online temperatures of the vessel shell since April 2021.

Based on this design, Q-Temp 2.0 elements have been installed on two 180 tonne converters in Brasil, which are operating since 2021 and 2023. There, 32 elements and two infrared cameras are arranged for temperature image of the complete vessel. In 2024, all three converters at voestalpine Stahl in Linz have been equipped with such elements monitoring the temperature of the top cone close to the tap hole.

In a next step, Danieli Corus upgraded the Q-Temp 2.0 sensor to enable shell deformationmeasurement. This "Q-Temp 2.1" element was developed and tested in the laboratory of Danieli Corus. The first prototype was then installed on converter #7 of voestalpine Stahl in Linz in November 2024. The deformation measurements are very promising and now the long term experience is under the focus. By end of 2024 a revamped 240 t LD-converter in Latin America came into operation, equipped with 12 Q-Temp 2.0 elements, two infrared cameras as well as 4 Q-Temp 2.1 elements.

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