SCR coated DPF for Marine Engine Applications

M. Kleinhenz[1], P. Lauer[1], A. Fiedler[1], A. Döring[1]

[1]MAN Energy Solutions SE, Stadtbachstr. 1, *86153 Augsburg, Germany*

Contact Manuel Kleinhenz: manuel.kleinhenz@man-es.com

Keywords After-treatment system, Marine application, SDPF, CRT, Sulfur resistance, Hydrothermal stability

Acknowledgements This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 634135.

Abstract

In context of this paper, a compact exhaust after-treatment system (EATS), which is applied to marine distillate engine applications, has been developed and validated to fulfil existing and upcoming emission legislations. In detail, a coating for selective catalytic reduction (SCR) in combination with a diesel particulate filter (DPF) enables the simultaneous reduction of NO_X and particulate matter (PM) in one component. In addition, the EATS comprises a diesel oxidation catalyst (DOC), which is installed upstream to the SCR coated DPF (SDPF) to provide the required NO_2 for the passive soot regeneration and the fast SCR. The layout of this EATS is state of the art for automotive applications. Nevertheless, the requirements of the desired application, especially the high sulphur resistance, result in a significant development effort. It is shown that the investigated DOC systems provide a remarkable NO_2 generation while using marine distillate fuels with a sulphur content up to 5000 ppm. Furthermore, it has been observed that substrates made of cordierite (Crd) lead to a significant deterioration of the SCR performance of the vanadium-based coating after hydrothermal aging (HTA) at 650 °C. Contrary to this, the combination of DPFs, which consist of silicon carbide (SiC), and vanadium-based coatings, enable a sufficient NO_X reduction as well as the required sulphur resistance and hydrothermal stability up to 650 °C. In addition, the backpressure behaviour of the SDPF system has been observed in full-scale on an engine test bed, showing the advantage of an asymmetric cell structure of the DPF.

Introduction

The reduction of pollutant emissions has become a major challenge for engine manufacturers including those of diesel engines for marine applications. Since 2016 ships, which enter the North American coast as well as parts of Canada and the Caribbean Seas, have to fulfil Tier III NO_X-