

# Development of Combustion Device using Catalyst and Dielectric Barrier Discharge

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The marine diesel-engine emit a large amount of particulate matter (PM). Due to using a heavy oil containing a large amount of the sulfur content. PM is composed of soot, a soluble organic component and sulfur content. Since the MARPOL Convention by the International Maritime Organization has entered into force in May 2005, NO<sub>x</sub> emissions regulations in the PM is in addition to the SO<sub>x</sub> 2008 year provided. Since it is expected that future further regulation is intensified. The development of the PM-collection device with respect to a ship becomes an urgent need. The authors considered the best that electrostatic precipitator (ESP) is a compact and low pressure loss, it has been studied. However, particles deposited on the electrode was found to degrade the performance due to long-time operation. In recent study, PM was combusted by using dielectric barrier discharge (DBD) [Y. Ehara, 2013]. In this paper significantly describes PM combustion by the DBD using a catalyst. The reactor was used as a packed bed type.

Fig.1 shows a reactor construction. The reactor had a coaxial double tube structure. The inner tube is made of aluminum and a high voltage electrode. The outer tube is made of quartz and wrapped with an aluminum foil, and a ground electrode. AC high voltage is applied between the inner electrode and the outer electrode. Air flows into the discharge part from the aluminum tube. The catalyst surface depositing the PM were filled into the reactor. PM is taken from the diesel generator was operated with light oil. The catalyst used was NS-1A (Nikki-Universal., LTD.). It is spherical and the diameter is about 4mm. Temperature inside the reactor was maintained at 400 °C. AC high voltage of 3kHz is applied to the reactor, DBD generate on the catalyst surface. The discharge power is set as about 7W.

Fig.2 shows a photograph of catalyst, (a) is catalyst, (b) is catalyst adding PM, (c) heated for 30 minutes at 400 °C. Since the PM is attached, (b) is black than (a). Generally PM is about 99% is a soot, combusts at about 600 °C. Since (b) has a lighter color than the (c), the catalyst makes sure that was combusted at a low temperature. Further, when DBD generate 30 minutes at 400°C, the catalyst surface becomes the state of (d). It was confirmed that almost PM combusted. Therefore, the PM combustion using DBD with a catalyst is considered effectively.

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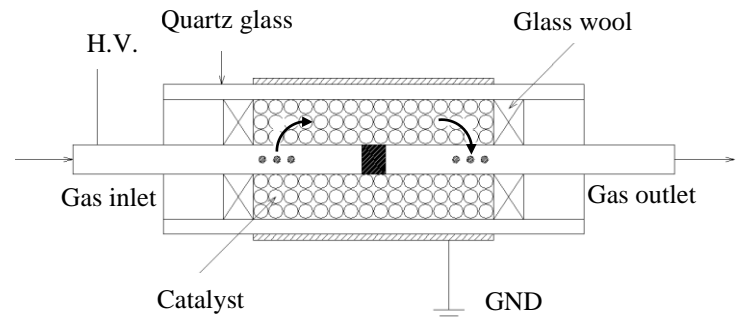


Figure.1 Packed-bed reactor



Figure.2. Combustion test results

Y. Ehara, M. Kobayashi, M. Hiromu, Z. Akinori, K. Hitomi, T. Inui(2013) " Diesel PM Incineration for Marine Emissions Using Dielectric Barrier Discharge Type Electrostatic Precipitator" Proc ESA Annual Meeting on Electrostatics,F3.