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Numerical Simulation of Condensation of Sulfuric Acid and Water in a Large Two-stroke Marine Diesel Engine J. H. WALTHER, N. KARVOUNIS, K. M. PANG, Technical University of Denmark — We present results from computational fluid dynamics simulations of the condensation of sulfuric acid (H_2SO_4) and water (H_2O) in a large two-stroke marine diesel engine. The model uses a reduced n-heptane skeletal chemical mechanism coupled with a sulfur subset to simulate the combustion process and the formation of SO_x and H_2SO_4 . Condensation is modeled using a fluid film model coupled with the Eulerian in-cylinder gas phase. The fluid film condensation model is validated against both experimental and numerical results. The engine simulations reveal that the fluid film has a significant effect on the sulfuric acid gas phase. A linear correlation is found between the fuel sulfur content and the sulfuric acid condensation rate. The initial in-cylinder water content is found not to affect the sulfuric acid condensation but it has a high impact on water condensation. The scavenging pressure level shows an inverse correlation between pressure and condensation rate due to change in the flame propagation speed. Finally, increasing the cylinder liner temperature significantly decreases water condensation but has a negligible influence on the condensation of sulfuric acid.

J. H. Walther
Technical University of Denmark

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