A computational analysis of the impact of bore-to-stroke ratio on emissions and soot level in propane-fueled engines

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This computational study investigates the impact of bore-to-stroke ratio on hydrocarbon (HC), carbon monoxide (CO), nitrogen oxide (NOx), soot levels, and residual gas fraction (RGF) in a propane-fueled spark-ignition engine. Using AVL-Boost software simulations and experimental data from a two-cylinder engine with a control dynamometer, the analysis evaluates emission profiles and combustion characteristics. Results show that the bore-to-stroke ratio's critical influence on optimizing HC, CO, NOx, soot, and RGF in propane-fueled engines. When increasing the bore-to-stroke ratio reduces HC and CO emissions, with a notable decrease in soot levels due to enhanced combustion efficiency. Conversely, NOx emissions increase with higher ratios, with the lowest NOx levels observed at a bore-to-stroke ratio of 0.88. The RGF exhibits minimal sensitivity to bore-to-stroke ratio changes, maintaining stability across tested ratios. Specifically, at a bore-to-stroke ratio of 0.966, HC and CO emissions are significantly reduced, while NOx peaks.

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