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(57) Abstract :
The present invention relates to an advanced piston bowl design for dual-fuel hydrogen-diesel engines, optimized to enhance combustion efficiency, emission control, and thermal management. The piston bowl integrates micro-channels for controlled hydrogen injection, radial grooves for enhanced air-fuel mixing, and an asymmetric curvature for stratified charge combustion. A stepped-lip structure ensures stable flame propagation, reducing knocking and abnormal combustion. The design includes dedicated regions for diesel pilot ignition and hydrogen-air premixing, preventing pre-ignition and ensuring precise combustion phasing. An adaptive wall thickness scheme improves heat dissipation, enhancing durability under high-temperature conditions. By optimizing fuel-air mixing, ignition timing, and flame control, the invention significantly reduces NOx emissions, improves fuel efficiency, and extends engine lifespan, making hydrogen-diesel dual-fuel technology more viable for sustainable applications.

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