A Theoretical Study on Water Injection into the Combustion Chambers

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Abstract:

The idea of water injection into the combustion chamber refers to the fact that this part of the engine is the most important source of heat lose. Although the cooling air which is used to cool the inner layer of the combustion chamber is contributed in engine cycle but still a considerable amount of heat is lost from this part without any contribution in engine power cycle into its surrounding.

Studies show that water injection not only leads to better cooling process of combustion chamber but also increases the engine cycle mass flow rate by using the heat lost. It means that turbine work and power will be increased.

Of course using vapor injection is possible too. It has to be injected after compression process or into the combustion chamber directly. But only a little portion of it passes through the primary zone of the combustion chamber and it has less effect on NOX production. While almost all of the produced water vapor passes through the primary combustion zone, if water injects through the combustion chamber. Study shows that water injection about %5 of total engine mass flow rate, causes % 15-20 power increment and highly decrement of NOX production in gas turbine. However since fuel consumption increases, therefore the overall thermal efficiency will be decreased.

Key Words:

Combustion Chamber – Water Injection – NOX

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