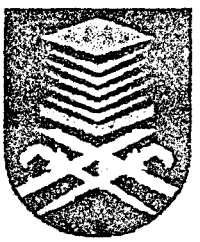
RADICAL COMBUSTION ENGINE CHARACTERISTICS STUDIES FOR PRODUCTION ENGINES



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CHAPTER 1

INTRODUCTION

1.0 Historical Background

The radical ignition (RI) process also called activated radical (AR) combustion is not exactly new, but only recently have engineers begun to exploit the process in practical power plants. These new units include a lightweight two-stroke racing motorcycle engine, truck diesels with reduced soot output, and lean burn spark ignited car engines. Several engines using radical combustion techniques are being developed today [1]. One in particular is the single cylinder, two-cycle engine that powers the EXP-2 off-road racing motorcycles developed by research engineers at Honda Motor Co. Ltd. in Tokyo [2].

Early on the development of the internal combustion engine, there were indications that something else was going on in fuel combustion. Owners of motorcycles, generators and other two-stroke power machines noticed that under certain unusual circumstances, these engines would "run on", that is it will continue running after the electrical ignition system was shut off. Most engineers had seen two-cycle engines revving away even though there were no sparking inside. They generally attributed this self ignition phenomenon to pre ignition caused by hot spots in the combustion chamber and it was generally dismissed without serious study.

In 1970s, Shigeru Onishi and his associates at Nippon Clean Engine Research Institute Co Ltd demonstrated a small single cylinder motor generator (called the NICE engine) that runs with no spark. The team called the phenomenon they observed active thermo-atmosphere combustion [2].

In 1992, the Honda R&D Asaka Center, under the leadership of Minoru Matsuda, established a small research project led by Yoichi Ishibashi, to determine whether this auto-ignition process could be used to solve the well known irregular combustion (misfiring) problem of two-stroke engine. They have found that the AR combustion induced by exhaust throttling could operate from roughly 5 percent of peak load to 60 percent. But it was most efficient from 6 to 22 percent of load-almost exactly in the range where misfiring causes the most problem in two-stroke engines. Ishibashi's group demonstrated several advantages of AR combustion: at low engine load, cycle-to-cycle variation in the combustion process is almost eliminated. The process eliminates misfiring and benefits from being a homogeneous, bulk combustion progress unaffected by the details of flow or air-fuel ratio near the spark plug.

Increase fuel economy derives from higher thermal efficiency because the engine loses less heat to the cooling system. That is because AR combustion is quicker than conventional spark-ignited combustion, requiring roughly 20 percent less time.

1.1 Project Background

As being reported, radical engine process can only be applied for 2 stroke engine [1]. The 2 stroke engine has an exhaust port where there are no valves or