2021-28-0238 Published 01 Oct 2021

SAE INTERNATIONAL

An Investigation on Corrosion and Wear Behavior of Automotive Materials

Sadhasivam Deepan Kumar Bannari Amman Institute of Technology

Boopalan N Kongu Engineering College

Nagarajan Praveenkumar and R Manojkumar Dr.Mahalingam College of Engg and Tech.

G E Kithiyon Joshva and J Sahaya Jufert Roy Bannari Amman Institute of Technology

Citation: Deepan Kumar, S., Boopalan, N., Praveenkumar, N., Manojkumar, R. et al., "An Investigation on Corrosion and Wear Behavior of Automotive Materials," SAE Technical Paper 2021-28-0238, 2021, doi:10.4271/2021-28-0238.

Abstract

The energy demand of the world is keep increasing, major share of the demand is compensated by non-renewable fossil fuels. Automotive sector consumes a huge amount of fossil fuels, as majority of the segment use internal combustion as a prime mover. In the present era researches are carried to figure out the suitable replacements for fossil fuels to attain sustainable environment. One of the major challenge and keen interest of everyone is on waste management, several researches are aimed to bridge the gap between energy demand and waste management. In such way biofuels came into limelight a decade ago, still numerous works are carried in the area for creating socio economic friendly environment. Enormous studies have been carried out to assess their performance in the internal combustion engines, here in the present study performance of the working material against the biodiesel is studied. In order to optimize the material and its composition, there is need for characterization against the susceptible factors such as corrosion and wear if bio fuels are employed as working fluid. In internal combustion engines the materials used in piston and its associated components have to encounter the working fluid; their endurance should be ensured before their service. The present work covers the characterization of cast iron and aluminum alloy used in piston against biofuel for corrosion and wear resistance. Test specimens are prepared as per the standards; biodiesel is prepared from waste cooking oil by transesterification process for carrying out the experiment. Corrosion rate analysis is carried out as per the standards using constant electric water temperature bath for 1300 hours and surface morphology of test specimens is studied with help of scanning electron microscope and energy dispersive spectroscopy. Aluminum alloy test specimens were prepared and wear rate analysis is done using pin on disc machine. The corrosion rate of cast iron is more compared to aluminum alloy by 40 % when the working fluid is neat diesel and the rate increases to 55 % if biodiesel is used as working fluid. The wear rate of aluminum alloy increases rapidly when the lubrication oil contamination increases.

Introduction

Population growth around the world is a serious threat in view of energy demand [1]. Nonrenewable fossil fuels are playing major role in meeting this demand till present era [2]. The extensive use of this nonrenewable fuel source is creating a non-repairable damage to the environment through harmful emissions after their combustion [3]. In order to balance out the raised challenges in the area of energy demand, hunting for renewable alternate energy sources is essential. After several researches biodiesel is hunted as one of the effective alternate fuel in place of neat diesel because of being renewable, biodegradable, economical and non-toxic [4, 5, 6]. Bio fuels takes the considerable amount of share from the fossil fuels in meeting out the energy demand and a huge trust is made on it because of less polluting emissions after combustion and extracted from cleaner sources [7, 8]. The highlighted advantage of biodiesel is it can be used directly or as a blend in diesel engines without any engine modifications [9]. The Cetane number of the biodiesel when compared with neat diesel is higher, similarly it has high flash point, lubricity [10, 11]. There are several disadvantages when biofuel is used as a working fluid in the IC engines such as corrosive nature, more hygroscopic, lower engine performance, high specific fuel consumption, increased wear rate in working components, less volatile and poor performance in lower operating temperature [12, 13, 14, 15]. In most of the countries biodiesel is used as a blend with neat diesel after promising results. After several researches the optimum blend value is recommended 20 % biodiesel 10 % ethanol 70 % diesel can yield in better engine performance and fewer emissions [16, 17, 18]. As the working fluid in the internal combustion engine is a blended fuel the properties of the working fluid is to be evaluated primarily before serving the