

Fuel Reformer



Mechanical Engineering

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AKSHAY P. KULTHE

BR Harne College of Engineering and Technology, Department of Mechanical Engineering, University of Mumbai

SUSHRUT C. JADYE

BR Harne College of Engineering and Technology, Department of Mechanical Engineering, University of Mumbai

DEVEN K. KADAM

BR Harne College of Engineering and Technology, Department of Mechanical Engineering, University of Mumbai

AKSHAY U. NAIK

BR Harne College of Engineering and Technology, Department of Mechanical Engineering, University of Mumbai

RAJ MHATRE

Department of Mechanical Engineering, Mahatma Gandhi Mission's College of Engineering and Technology, University of Mumbai.

ABSTRACT

In this era of great industrialization and innovation where markets are getting flooded with latest technological advancements, exhaustion of conventional fuels and threat to pollution are continuously rising at an alarming rate. This indicates that the world needs to come up with something radical and more environment friendly that can be a guiding pillar towards sustainable future. With around a Billion of cars running in this world with conventional fuel there is dire need towards a greener and cleaner fuel alternative for a better future and in this race Hydrogen based Fuel Cells stands a strong contender but creating it is not very simple so this we make use of Fuel Reformer extracts the pure hydrogen from a hydrogen source, such as hydrocarbon or alcohol fuels, and then provides the hydrogen to the fuel cell

I. INTRODUCTION

We already have the technology we need to cure our addiction to oil, stabilize the climate and maintain our standard of living, all at the same time. By transitioning to sustainable technologies, such as solar and wind power, we can achieve energy independence and stabilize human-induced climate change. Increasing transportation efficiency is the best place to start efforts to reduce emissions of carbon dioxide (CO₂), which is a primary culprit in global warming. Of all CO₂ emissions in the World, about 38 percent comes from transportation. Electric shows the overwhelming advantages of electric cars — plug-in hybrid vehicles and all-electric vehicles (EVs) — over gasoline vehicles. With gasoline-electric hybrid power and all-electric power, we can achieve significant cost and environmental savings. By adding more batteries and recharging capability to gasoline-electric hybrid vehicles, we can have plug-in hybrids that offer the range of hybrids (500 miles or more), plus the benefit of all-electric power for short trips, which dramatically reduces the amount of gasoline used. EVs require no gasoline whatsoever and, when recharged from renewable energy sources, produce zero total emissions. In fact, even if we switched from gasoline cars to EVs and plug-in hybrids recharged by our existing utility grids (which mostly use fossil fuels), we would see a 42 percent national average reduction in CO₂ emissions. Cars today are largely a mechanical process in an internal combustion engine. In a fuel cell car, there is no combustion taking place, and therefore it has 60% fewer parts overall and 90% fewer moving parts. Many of the traditional components in cars today are not present, such as spark plugs, pistons and a transmission. There is growing interest in the replacement of batteries by fuel cells for portable consumer electronics such as cellular phones, laptop computers, digital cameras etc. At first sight, comparisons with batteries based on performance and convenience are encouraging. However, the cost and safety aspects of small fuel cells based on conventional electrochemistry will need to be addressed before there is widespread commercialization. At Present Steam methane reforming (SMR) is currently the primary pathway for hydrogen production worldwide. However, due to its high operating temperature and use of sequential units for the reaction stages, industrial SMR does not scale down well for distributed, point-of-use applications such as fuel cell vehicle refueling stations. So this is where hydrogen fuel reformer brings a change, the reformer is the device that extracts the pure hydrogen from a hydrogen source, such as hydrocarbon or alcohol fuels, and then provides the

hydrogen to the fuel cell. Since the hydrogen fuel reformer is extracting the hydrogen itself, the reformer has to clean up the hydrogen and separate it from the rest of the heat and gases that get produced during the reforming process.

II. OBJECTIVE

Fuel however, is a finite resource, the cost of which increases sharply as the availability decreases. They become more difficult to mine as reserves are diluted. But while they still account for most of the electricity produced in the world there are major problem areas such as *security of supply and environmental factors*. The release of hazardous chemicals from fossil fuel combustion cause unknown quantities of people to be diagnosed with ailments such as heart disease, cancer and respiratory disease and developmental impairments — especially vulnerable groups such as children and the elderly. Toxins include oxides of nitrogen (Nox), oxides of sulphur (SOx), and fine particulates which cannot be filtered, including heavy metals. Dioxins, also formed during combustion are known carcinogens. In addition, Fuels produce vast quantities of 'green house gases' most notably CO₂ (Carbon Dioxide). This doesn't sit well with aggressive EC targets to cut CO₂ emissions. So here **eco-friendly vehicle or environmentally-friendly vehicle** is a road motor vehicle that produces less harmful impacts to the environment than comparable conventional internal combustion engine vehicles running on gasoline or diesel, or one that uses certain alternative fuels. Presently, in some countries the term is used for any vehicle complying or surpassing the more stringent European emission standards, or California's zero emissions vehicle standards or the low-carbon fuel standards enacted in several countries. Green vehicles can be powered by alternative fuels and advanced vehicle technologies and include hybrid electric vehicles, plug-in hybrid electric vehicles, battery electric vehicles, compressed-air vehicles, hydrogen and fuel-cell vehicles, neat ethanol vehicles, flexible-fuel vehicles, natural gas vehicles, clean diesel vehicles, and some sources also include vehicles using blends of biodiesel and ethanol fuel or gasohol. Most of On the other hand, reformers used for fuel cell applications, particularly proton-exchange membrane applications, will be highly concerned about minimizing CO in the exhaust (as CO in concentrations greater than 20 ppm is a poison for anode catalysts in PEM fuel cells). Thus, a reformer for fuel cells will incorporate a downstream water-gas shift reactor which uses additional H₂O to react with CO to form more H₂ and CO₂. The water-gas shift reactor,

which is an area of current research, will also increase the exit H₂ mole fraction, which is important for maintaining high fuel cell efficiencies.

V. RESULT

The above plot shows the operating bounds of a fuel reformer operating on a kerosene-like fuel. Higher H₂O inlet concentrations cause the reactor temperature to drop below the limit where catalysts can be expected to be active (around 600 K) and lower H₂O inlet concentrations cause the reactor temperature to rise above catalyst temperature limits. For gas turbine applications where H₂ production can improve combustor stability and lower emissions, exit mole fractions of H₂ do not need to be high and a designer would favor a lower H₂O/air split. With stoichiometries for H₂ and CO production, an H₂O mass < 20% of the fuel mass can provide H₂ exit mole fractions as high as 33%. Such H₂ exit concentrations can enhance downstream flame stability both for lean and high-speed combustor applications. For fuel cell applications, higher H₂O/air-split would be desirable to produce higher H₂ exit concentrations with stoichiometries for H₂ and CO₂, since even low CO concentrations will poison fuel cell anodes. For such operating conditions, H₂ exit mole fractions above 50% can be achieved before reactor temperatures begin to drop below expected catalyst light-off temperatures

Our study is looking at the basic performance of reforming catalysts in sub-scale reactors. The experimental observations will indicate the viability of achieving rapid start-up and minimization of reactor volume and expense.

VI. CONCLUSION

The objectives of our research in fuel reforming center on developing a fundamental catalyst performance data-base for single-component alkane fuels and validating a reduced chemical mechanisms for designing actual reformers with low residence times and high fuel conversion. or heads, are organizational devices that guide the reader through your paper. In the attempt to acquire competence in automotive fuel cells, automakers have engaged in an extensive research network worldwide. A fuel cell system running on hydrogen using fuel reformer techniques can be compact and lightweight, and have no major moving parts. Because fuel cells have no moving parts and do not involve combustion, in ideal conditions they can achieve up to 99.9999% reliability.[69] This equates to less than one minute of downtime in a six-year period. Reducing cost and improving durability are the two most significant challenges to fuel cell commercialization. Fuel cell systems must be cost-competitive with, and perform as well or better than, traditional power technologies over the life of the system. So to involve fuel reformer techniques in picture we can surely head towards a sustainable society with lesser pollution rate but the major barrier in this scenario is the financial element Of course, so that fuel cells get implemented, further work needs to be conducted on their performance. The effects of service life need to be quantified, and the appropriate reformer modules need to be designed and tested so the everyone can make use of it

VII. FUTURE SCOPE

With Fuel Reformers coming in Picture and taking its place to replace the convetional fuels hydrogen can be effectively used as a source to generae Electricity . Apart from that When hydrogen is burnt to produce fuel, the byproducts are totally safe, which means, they have no known side effects. Aeronautical companies actually use hydrogen as a source of drinking water. After hydrogen is utilized, it is normally converted to drinking water for astronauts on ship or space stations. Hydrogen energy is non-toxic. This means that it does not cause any harm or destruction to human health. This aspect makes it preferred compared to other sources of fuel like nuclear energy, natural gas, which are extremely hazardous or daunting to harness safely. It also allows hydrogen to be used in places where other forms of fuel may not be allowed. Hydrogen energy's efficiency and power makes it an ideal fuel source for spaceships. Its power is so high that

it's able to quickly rocket spaceships to exploration missions. It's also the safest form of energy to perform such an energy-intensive task. Hydrogen energy is in fact 3 times more potent than gasoline and other fossil-based sources of fuel. This ideally means that you need less hydrogen to complete an enormous task. It also offers motive power for airplanes, boats, cars, and both portable and stationary fuel cell applications. The downside to using hydrogen in cars is that it's practically difficult to store in cryogenic or high-pressure tanks. *Hydrogen* fuel cells offer in effect the highest benefits in terms of efficiency and emissions, but the production and distribution of hydrogen, its safe on-board storage imply problems that require a vast amount of R&D investments to achieve a reliable engineering level and the costs sustainable by the private automotive mass market.

VIII. REFERENCE

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