How does the ratio of hydrogen () to 0.01 mol of oxygen () effect the size of the reaction?

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Personal engagement

My life relies on the combustion reaction: my ride to school requires hydrocarbon fuel to power cars, I use coal powerplant generated electricity to power my computer, I use natural gas to cook my food. However, most of these reactions are incomplete combustion reactions, and produces nitrogen oxides in the process. Since nitrogen oxide is a greenhouse gas, it will increase the effects of global warming. An interesting alternative to the incomplete combustion of fossil fuels is the reaction of hydrogen and oxygen, as this complete combustion reaction only produces heat and water. With interest in the feasibility of using this reaction to replace traditional incomplete combustion reactions, I have decided to investigate the relationship between the ratio of hydrogen to oxygen and the size of reaction.

References

A, Milbrandt, and Mann M. “Potential for Hydrogen Production from Key Renewable Resources in the United States.” *U.S. Department of Energy*, National Renewable Energy Laboratory Golden, Feb. 2007, afdc.energy.gov/files/pdfs/41134.pdf.

The national library of the U.S. Department of Energy wrote this report upon the feasibility of using hydrogen fuel as a major source of energy for the USA. This report has a strong focus on the Geographic feature, with analysis of the geographic location of hydrogen production plants, the amount of hydrogen each city in America contains, and the feasibility of using hydrogen as a renewable resource. This source helps to provide an insight of the general view of the future of hydrogen becoming a mainstream fuel. This is important because it compares it with different options to allow better understanding of the realistic aspects, such as strength and weaknesses, of hydrogen fuel. - 142

Chiavazzo, Eliodoro, et al. “Method of Invariant Grid for Model Reduction of Hydrogen Combustion.” *Proceedings of the Combustion Institute*, vol. 32, no. 1, 2009, pp. 519–526., doi:10.1016/j.proci.2008.05.014.

Researchers from the university of Southampton wrote this paper upon the theoretical aspects of the combustion reaction. It displays a model which uses the detailed kinetics of molecules to deduce the thermal energy produced in a realistic combustion reaction. This is helpful as it provides insights to the theoretical aspect of the reaction of hydrogen fuel. This can help deduce the fuel consumption to power ratio, mass to energy ratio, and various other important numbers important when evaluating the reliability of hydrogen fuel. Furthermore, this paper provides more insight on how the reaction actual occur. This creates a visual image to better understand what is causing the reaction to happen, and how the reaction happens under the surface of the burning flames. -150

*Combustion of Hydrogen in Air*. 2009, [www.rsc.org/learn-chemistry/resource/res00000438/combustion-of-hydrogen-in-air?cmpid=CMP00004982](http://www.rsc.org/learn-chemistry/resource/res00000438/combustion-of-hydrogen-in-air?cmpid=CMP00004982).

The LearnChemistry organization published this experiment procedure aiming to help people understand how the combustion reaction of hydrogen and oxygen works. The experiment does so by setting up a safe environment for the hydrogen and oxygen to react, and measuring the change in volume of the gases at the end. This is helpful as it provides an example of a safely designed experiment which is possible to preform in school, and measuring the energy produced by the combustion reaction. The procedure provides many details such as using a system made up of test tubes, delivery tubes and water to measure gas. While these are only minor detail, they would be really helpful as they provide insight on how to design a safe experiment, and also listed key safety instructions to help prevent any dangerous situations to occur. - 144

Maas, U., and S.b. Pope. “Simplifying Chemical Kinetics: Intrinsic Low-Dimensional Manifolds in Composition Space.” *Combustion and Flame*, vol. 88, no. 3-4, 1992, pp. 239–264., doi:10.1016/0010-2180(92)90034-m.

This paper introduces the Intrinsic Low-Dimensional Manifolds approach to the mechanism of a combustion reaction. This will be helpful as it will provide understanding of how the combustion reaction itself works, and it illustrates a detailed picture of how everything is happening. While many points in this paper is hard or requires previous knowledge to understand, just scratching the surface of the theory will be helpful in understanding the reaction between hydrogen and oxygen, as it outlines the base of what happens in a combustion reaction. This paper is particularly helpful because it approaches the subject in a realistic manner: it analyzes the results of different reaction, including reactions which the conventional mechanisms fail to describe, to produce a valid theory. - 147

Scientific American. “Why Does Combining Hydrogen and Oxygen Typically Produce Water Rather than Hydrogen Peroxide?” *Why Does Combining Hydrogen and Oxygen Typically Produce Water Rather than Hydrogen Peroxide?*, www.scientificamerican.com/article/why-does-combining-hydrog/.

This journal by Scientific American gives a general overview of why hydrogen and oxygen would react to each other. It talks about the type of reaction this is, and how this reaction is caused by the two different molecules exchanging electrons to form bonds. While the information in this journal seems simple, it does a great job explaining how all those concepts specifically applies to this combustion reaction of hydrogen and water. It contains many materials that have been taught in class, and thus will act as a great starter to this topic, as it can help refresh many of the base concepts needed to understand the more advanced portion of the reaction. - 142