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Zeller

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[54] **FUEL FOR MAGNETOHYDRODYNAMIC GENERATOR**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 177,876, Sept. 3, 1971.

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **149/22,** 149/87, 44/57, 44/66, 44/80

[51] **Int. Cl.** **C06b 15/00**

[58] **Field of Search** ..... 149/22, 87, 109; 44/57, 44/66, 80; 260/526 R

[56] **References Cited**

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[57] **ABSTRACT**

A fuel for a magnetohydrodynamic generator in which readily ionizable seed material additives of potassium compounds, and if desired performance boosting metallic additives, are suspended in a carrier liquid such as kerosene, benzene, toluene or like fuel carrier hydrocarbons, said seed material additive being an organo-metallic compound, namely $C_8H_{15}O_2K$.

10 Claims, No Drawings

FUEL FOR MAGNETOHYDRODYNAMIC GENERATOR

CROSS-REFERENCE TO RELATED APPLICATION

This co-pending application is a continuation-in-part of application Ser. No. 177,876 filed on Sept. 3, 1971.

This invention relates to a fuel for a magnetohydrodynamic (MHD) generator in which readily ionizable seed material additives of potassium compounds and simultaneously, if so desired, performance boosting or power-increasing metallic additives are suspended in a carrier liquid of kerosene, benzol, toluol or other like hydrocarbons and in particular to a fuel wherein the ionizable seed material is an organometallic compound.

In the copending patent application Ser. No. 177,876, filed on Sept. 3, 1971, provision is made for stabilizing a fuel suspension by the admixture of Bentone 34, Thixogel or Aerosil in the amount of maximally 10 percent by weight in the form of a thixotropic gelling agent to prevent the fuel additives from precipitating or separating over extended periods from the fuel.

Advantageously, it has been found in accordance with this invention that a fuel for magnetohydrodynamic generatorsis further enhanced by use of an organo-potassium compound as the seed material additive. A general object of the present invention is to provide a fuel which is not only maximally homogeneous but which by the nature of its composition produces a high level of temperature and conductivity of the hot gases upon combustion and so permits a fuel supply system which greatly facilitates the manipulation of an MHD generator.

It is a particular object of the present invention to facilitate the production of a fuel of the above cited type by the use of $C_8H_{15}O_2K$ as a seed material additive with a content in the fuel of up to 37.4 percent by weight.

$C_8H_{15}O_2K$, a potassium salt of ethylhexane acid [which acid is also known as 2-ethylhexanoic acid or α-ethyl caproic acid-$CH_3(CH_2)_3CH(C_2H_5)COOH$] is directly soluble in kerosene, benzene or toluene, so that conversion to a thixotropic gelling agent is then not required. The maximum possible concentration of potassium in the $C_8H_{15}O_2K$ and kerosene solution is 12 percent by weight, which corresponds to an $C_8H_{15}O_2K$ concentration of 56% by weight in the solution. This stock solution possesses a relatively high viscosity (1,870 cps at 20°C.) which prevents the solution from being injected directly as a fuel. The maximum useful concentration of potassium in magnetohydrodynamic service is approximately 8 percent by weight which corresponds to a solution containing 37.4 percent by weight of $C_8H_{15}O_2K$ in kerosene (70 cps at 20°C.). To this end the stock solution must be diluted under vigorous agitation by the admixture of kerosene. Any desired concentration of potassium between 12 percent and 0 percent by weight can be standarized; for instance: addition of 50 kg kerosene to a 100-kg solution of $C_8H_{15}O_2K$ in kerosene containing 12 percent potassium by weight will produce a solution having a potassium content of 8 percent.

Theoretical investigations have shown that an optimally suitable fuel is achieved at a potassium concentration of 8 percent by weight. It will be understood that a potassium concentration as low as about 2 percent and as high as about 10 percent by weight is also useful for such fuels. It will be appreciated that the maximum concentration for the potassium salt is 37.4 percent by weight in each of the various hydrocarbon carrier liquids.

Also, the minimum concentration will be about 9.4% by weight of the potassium salt. Consequently, in a two component system the amount of carrier liquid may vary from about 62.6% to 90.6% by weight of the fuel. In fuel containing other additives, the amount of carrier will be proportionally reduced.

The formation enthalpy of $C_8H_{15}O_2K$ is sufficiently high so that the combustion temperature will be extremely high and the combustion products will have a large degree of conductivity.

If use is made optionally of performance boosting additives, such as Al, B, Li, Mg or alloys thereof, the $C_8H_{15}O_2K$ and kerosene solution will likewise have to be converted to a thixotropic gelling agent with the aid of a suspending agent of the type heretofore described. Moreover, it will be understood that the amounts of performance boosting additives and suspending agents used are the same as heretofore described in the copending parent application.

Also, the advantages cited in the copending parent application are fully retained in the fuel of the present invention. Inasmuch as the seed material is admixed within the fuel, the generator injection process is simplified. The need for more than two injection systems for the MHD fuel and the oxidator is eliminated. Homogenization of the fuel in the mixing tank ensures uniform distribution of the seed material already before combustion occurs. This prevents fluctuations in the conductivity during generator operation.

The fuel of this invention will be further understood from the following examples:

EXAMPLE 1

A fuel for a magnetohydrodynamic generator is prepared by mixing 37.4 grams of potassium salt of ethylhexane acid with 62.6 grams of kerosene in mixing device to produce a solution having a concentration of 37.4 percent of the salt and viscosity of 70 cps at 20°C. The resulting solution is used as fuel which is stored in a conventional tank and then injected with the aid of pressure gas feed system into a combustion space of generator and is combusted with oxygen introduced into the combustion space by a second injection system. It is determined that fuel provided extremely high combustion temperature required for use in such generators.

EXAMPLE 2

By following the procedure set forth in Example 1, additional fuels are prepared using benzene and toluene and are evaluated. In these runs the optimum amount of potassium is found to be about 8 percent by weight, i.e., the concentration of the salt is about 37.4 percent by weight. In each case it was found resulting fuel exhibited high temperature combustion characteristics required when combusted with oxygen.

While the novel principles of the invention have been described, it will be understood that various omissions,

modifications and changes in these principles may be made by one skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A fuel of a magnetohydrodynamic generator which comprises the potassium salt of ethylhexanoic acid admixed with a fuel carrier liquid selected from the group consisting of kerosene, benzene, and toluene, said postassium salt enhancing combustion characteristics of said fuel.

2. The fuel of claim **1,** wherein said fuel carrier liquid comprises a hydrocarbon or mixtures of hydrocarbons.

3. The fuel of claim **2,** wherein the content of said potassium salt in said fuel is as high as 37.4 percent by weight based on the total weight of said fuel.

4. The fuel of claim **4,** wherein said potassium salt is dissolved in said fuel carrier liquid and the concentration of said potassium salt varies so that the content of potassium within said fuel is from about 2 to about 10 percent by weight.

5. The fuel of claim **2,** wherein said potassium salt is dissolved in said fuel carrier liquid, the content of said potassium salt being such that the viscosity of said fuel is sufficiently fluid to be injected into the combustion space of a magnetohydrodynamic generator.

6. A fuel for a magnetohydrodynamic generator which comprises the potassium salt of ethylhexanoic acid admixed with a fuel carrier liquid selected from the group consisting of kerosene, benzene, and toluene, the content of said potassium salt being sufficient to provide from about 2 to 8 percent by weight of potassium in said fuel.

7. The fuel of claim **6,** wherein said potassium salt is dissolved in said fuel carrier liquid to form a solution, the concentration of said potassium salt in said solution ranging from about 9.4 to 37.4 percent by weight.

8. The fuel of claim **6** further comprising at least one performance boosting metallic additive suspended in said fuel carrier liquid, said fuel carrier liquid also containing a suspending agent in sufficient amounts to effect suspension of said metallic additive.

9. The fuel of claim **8,** wherein said performance boosting metallic additives include Al, B, Li, Mg or the alloys thereof.

10. The fuel of claim **9,** wherein the concentration of said metallic additives is up to about 75 percent by weight of said fuel and the amount of suspending agent is up to about 10 percent by weight of said fuel.

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