HyCoal: The new clean burning coal with hydrogen additive

Wednesday, 2 January 2008

HyCoal: THE NEW CLEAN BURNING COAL WITH HYDROGEN ADDITIVE

Extracted from a paper written by Dr. R. M. Santilli
Issued October 2002, revised November 2004, August 2007

THE ISSUE

Coal is no longer environmentally acceptable as a fuel because of excessive pollutants in its combustion exhaust. These pollutants are mainly "unburned" hydrocarbons (HC). The current methods of coal combustion release only part of its energy content; the rest is released in the exhaust through incomplete combustion. An improvement of the quality of the exhaust would imply an increased use of the coal thermal content, resulting in higher efficiency, and a higher energy release from a given amount of coal - or the release of the same thermal energy from a lesser amount of coal.

EXISTING PROCESSES

Most past efforts to render combustion of coal to be environmentally acceptable were based on the conversion of coal into a gaseous or liquid fuel (i.e., the process of "coal gasification"; the gas was turned into a liquid form via Fisher-Tropsch catalytic towers), a method used by the Germans during WWII.

Despite rather extensive investments over the years since WWII, none of the coal gasification processes have achieved environmentally acceptable results because of high hydrocarbon combustion emission content.

There is little potential in achieving conventional conversion of coal into a clean burning fuel because of technical difficulties in avoiding the presence of heavy hydrocarbons in the fuel exhaust.

USE OF THE MAGNEGAS TECHNOLOGY TO CLEAN COAL COMBUSTION

The MagneGas Technology offers a realistic possibility of making coal an environmentally acceptable fuel. The approach is to improve the quality of coal combustion by using commercially available coal, and introducing MagneGas and its components as gaseous or liquid additives.

Among the additives available in nature to clean coal combustion, hydrogen is by far the best; hydrogen burns at the highest temperature and has the fastest propagation speed of all fuels. Using hydrogen as an additive to coal will result in a dramatic improvement of the quality of the exhaust emissions. The combustion of hydrogen with coal increases the combustion efficiency of the unburned coal hydrocarbons in proportion to the percentage of hydrogen added. Achievement of the desired quality of the coal exhaust depends on the selection of the appropriate percentage of hydrogen as an additive.

However, extracting hydrogen by conventional methods is expensive, having a retail cost of about 50 times that of natural gas. Secondly, hydrogen is a gas and coal is a solid, posing a difficulty in achieving a mixture or bond. These are the basic reasons why hydrogen has not been used as an additive to coal for the improvement of its combustion exhaust.

The patented MagneGas Technology provides a reasonable way to improve the combustion efficiency of coal because:

1. When produced in sufficient volume, MagneGas is cost competitive with respect to existing fossil fuels;

2. MagneGas contains 50% to 60% hydrogen; and

3. MagneGas possesses a unique characteristic (due to magnetic polarizations of the orbitals of its individual atoms) that causes the gas to adhere to other substances.

The adhesion of MagneGas to coal is enhanced due to the nature of carbon atoms and their capability to easily acquire magnetic polarizations by induction. Normally, carbon atoms in coal have no polarization. However, when exposed to the relatively high magnetic polarization of MagneGas, carbon atoms in coal instantly acquire a magnetic polarization of at least some of their peripheral orbitals. Even though one is gas and the other is solid, MagneGas and coal bond to each other via magnetic forces among opposing polarizations, as established by chemical analyses done in the U.S.A. and, independently in Europe.

MagneGas is produced by PlasmaArcFlowÂª Recycler units that convert hydrogen-rich liquid wastes (such as city, farm or ship sewage, engine and cooking oil waste, crude oil, etc.) into MagneGas by flowing said liquids through a submerged electric arc between electrodes composed of a proprietary mixture of materials including coal.

Coal is used in the production of MagneGas, which can be an additive that would render coal into an environmentally friendly fuel; the synergy between the MagneGas Technology and the coal industry is obvious.

CERTIFICATION OF THE MAGNEGAS EXHAUST

MagneGas fuel was shown by EPA accredited laboratory analysis results to be suitable for use as automotive fuel without catalytic converters while surpassing all current EPA requirements for combustion exhaust emissions, as shown below.

Element	MagneGas (MG)	Natural Gas	Gasoline	EPA Standards
Hydro-carbons	0.026 gm/mi	0.380 gm/mi 2460% of MG emission	0.234 gm/mi 900% of MG emission	0.41 gm/mi
Carbon Monoxide	0.262 gm/mi	5.494 gm/mi 2096% of MG emission	1.965 gm/mi 750% of MG emission	3.40 gm/mi
Nitrogen Oxides	0.281 gm/mi	.732 gm/mi 260% of MG emission	0.247 gm/mi 80% of MG emission	1.00 gm/mi

Carbon Dioxide	235 gm/mi	646.503 gm/mi 275% of MG emission	458.655 gm/mi 195% of MG emission	No EPA standard exists for Carbon Dioxide
Oxygen	9%-12%	0.5%-0.7% 0.04% of MG emission	0.5%-0.7% 0.04% of MG emission	No EPA standard exists for Oxygen

The data were obtained using a Honda Civic adapted to run on natural gas and used with MagneGas without any change in timing and stochiometric ratio. The data on gasoline were obtained via the use of an identical Honda Civic running on gasoline. All data were obtained using the complex EPA routine simulating various city and mountain driving conditions.

The quality of MagneGas exhaust is dramatically better than that of natural gas and gasoline. MagneGas exhaust is much lower than EPA requirements; has about 50% less green gases (CO_2) than gasoline exhaust; and contains 9% to 12 % breathable oxygen. *MagneGas is the only known fuel whose exhaust can sustain life* (hydrogen exhaust cannot sustain life because of the lack of oxygen). Note that the data on MagneGas could be improved by optimization of timing and stochiometric ratio.

Based on these measurements, it is postulated that MagneGas fuel can be used as an additive to fossil fuels to improve their exhaust characteristics**.**

In first approximation it is now possible to pre-select the desired improvement of fossil fuels exhaust and then compute the needed percentage of MagneGas as additive from the above table.

HY-COAL AND SUPER-HY-COAL

MagneGas Technology can be used to clean coal combustion using the following processes with:

PROCESS I: Use of MagneGas as Additive in a Coal Furnace.
International Patents Pending
The first measurable results were obtained by simply injecting MagneGas into the coal flame in a furnace. In this case, the hydrogen content of MagneGas burned the un-combusted HC and CO content of coal exhaust, and the oxygen content of MagneGas decreased the oxygen depletion caused by coal combustion. The desired quality of the coal combustion exhaust depends on the selected percentage of MagneGas as a combustion additive.

PROCESS II: Production of the new HyCoal with MagneGas Additive.
International Patents Pending.
The second process uses a new type of coal called **HyCoal** because of the high content of hydrogen contained under the magnecular bonds. HyCoal can be produced by impregnating ordinary coal with MagneGas at high pressure. Despite its gaseous nature, a significant percentage of MagneGas remains bonded to coal with a minimal vapor pressure (maintained by using bags), resulting in improvements of the coal combustion exhaust essentially similar to those of Process I.

The new HyCoal as per Process II can be used jointly with MagneGas additive per Process I to clean coal combustion exhaust in existing furnaces without other changes. HyCoal is a new

type of clean burning coal that can be sold to consumers via existing sales organizations. Due to the rapidly increasing awareness of environmental problems by consumers, and the cost competitiveness of HyCoal over existing coal for same thermal energy content, the sale of HyCoal for consumer use should be well received.

PROCESS III: Production of SuperHyCoal with MagneLiquid Additive.
International Patents Pending.

According to a chemical law, all gaseous fuels can be catalytically liquefied in a Fisher-Tropsch Tower by the exposure of the gas to certain metallic and other catalysts at certain pressures. This is the process used by the German Army to product its liquid fuel during WWII and the process is still used today for the production of Liquid Petroleum (the liquefied version of natural gas).

The same process applies for MagneGas that can be catalytically liquefied in a Fisher-Tropsch Tower resulting in the new fuel called **"MagneLiquid."** The cost of the catalytic liquefaction per gallon of MagneLiquid is nil because metallic catalysts are not consumed in the process, Fisher-Tropsch Towers are automatic and have no appreciable personnel cost per gallon, and the amortization of the cost of the Tower per gallon of MagneLiquid is not measurable since that cost has to be proportioned over hundreds of millions of gallons produced over 5-7 years.

The catalytic liquefaction of MagneGas produces a large quantity of heat since it deals with the transition from the gaseous to the liquid state. That heat can be used via heat exchanges for desalting seawater by evaporation, heating up buildings, and other uses. Finally, a Fisher-Tropsch Tower can be easily added to the existing PlasmaArcFlow Recyclers without the intermediary use of compressors, because PlasmaArcFlow Recycler can be built to operate at the pressure needed for the catalytic liquefaction of MagneGas.

Once produced, MagneLiquid can be easily used for the impregnation of ordinary coal, resulting in a new coal product called **"SuperHyCoal"** with a percentage of hydrogen impregnation projected to be higher than that permitted by MagneGas in HyCoal.

SuperHyCoal can be used with MagneGas as an additive per Process I to clean the exhaust of existing coal burning furnaces without significant modifications. Seemingly, SuperHyCoal could be sold to consumers and have a dramatic market potential.

CONCLUSIONS.

1) Despite large investments over several decades, the use of conventional technologies has failed to process coal into an economically and ecologically acceptable fuel. It is evident that the survival, let alone the expansion, of the coal industry under increasing environmental restrictions requires a new vision and technologies.
2) Hydrogen is the best additive to improve coal combustion exhaust because of its high available flame temperature and propagation speed that promote the combustion of the unburned hydrocarbons in coal exhaust.
3) Hydrogen, as now produced, cannot be used as coal additive because of its properties and prohibitive production cost methods (electrolysis of water or reformations of fossil fuels).
4) The MagneGas Technology is available now for the production of a clean burning fuel gas

(containing 50% to 60% hydrogen) that is cost competitive with respect to existing fossil fuels.

A hydrogen rich fuel is now available for use as additive to coal that will enhance its combustibility at reasonable costs.