MagCare

Burning Fuel Efficiently

MAGCARE BOILER AND GAS TURBINE FUEL OIL ADDITIVES

Globally coal, crude oil, residual oil, gas etc., are fired as fuel in power plants. Combustion of these fossil fuels release SO_x, NO_x, CO_2, CO, PM etc., and they need to be addressed.

The residual oil has Vanadium, Sodium and Sulphur and on burning it causes corrosion in boilers, turbines and associated ancillary equipment.

To combat the corrosion and to protect the environment from emissions fuel oil additives are used.

MagCare manufactures and offers a wide range of Fuel Additives used as corrosion inhibitors in residual fuels for applications in Boilers, Gas Turbines and Coal powered Boilers to improve the life of the combustion equipment and to keep the environment clean.

MagCare products are developed and manufactured using the highest quality and safety standards. Ours is an innovative speciality chemical company providing more economical and environmental friendly products for the customers in the Power, Oil Refinery and Marine Industries.

MagCare's fuel oil additives are applied in:

- Steam power plants
- Gas turbines
- Oil refining
- Marine boilers

Magnesium in Fuel oil additives combats corrosion. Iron derivatives accelerates combustion. The alternate technology for improving combustion is to fire Water-in-Oil (WIO) emulsion.

Magcare has complete range of fuel oil additives as described below:

1. Inorganic MgO or $Mg(OH)_2$ slurries which comprise nano particles. They have large surface area, are highly reactive and consume less.

   Our MgO based Magcare 30B and Magcare 60C additives are highly reactive and efficient. We also have highly reactive $Mg(OH)_2$ additives in our range.

2. Our WIO technology improves combustion due to secondary atomization, reduces fouling and keeps environment clean by reducing particulates.

3. Our range of Gas turbine additives are oil soluble Organo-Metallic Magnesium and inorganic $Mg(OH)_2$. They inhibit Vanadic corrosion.

4. Our Organo-Metallic oxidation catalysts reduce soot up to 60% in boilers and down to 50 mg/Nm3 in turbines.

ADDITIVE REACTIONS:

Hot End Neutralization Reaction:

$MgO + V_2O_5 \rightarrow 3MgO \cdot V_2O_5$

V_2O_5 and the reactions products of Na with V formed during the combustion are low melting and highly corrosive. Magnesium reacts with these corrosive products and form Magnesium Ortho Vanadate which is high melting and non-corrosive. This is soft and friable and can be removed by soot-blowers.

Cold End Neutralization Reaction:

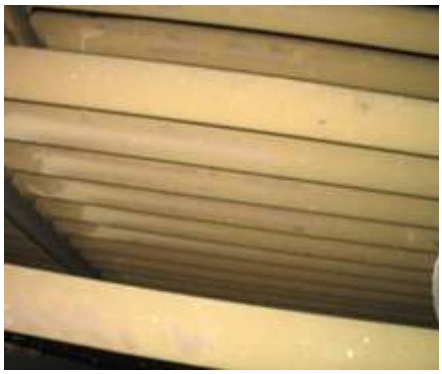
$MgO + SO_3 \rightarrow MgSO_4$

$MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$

$MgSO_4$ is a neutral and non-corrosive product.

BENEFITS OF EMPLOYING MAGCARE RANGE OF BOILER FUEL OIL ADDITIVES:

- Prevents hot end corrosion due to Vanadium and Sodium and cold end corrosion due to Sulphur.
- Neutralizes all additional SO_3 generated by SCR.
- Maintains lower boiler conversion rate.
- Converts all hard and tenacious ash deposits of Vanadium & Sodium eutectics to soft and friable.
- No “White Effect” and hence no increase in temperature of convective section and consequent Eco-out temperature.
- Neutralization of all condensing SO_3 at the cold end lowers ADP and hence the stack temperature can be reduced to save the fuel.
- At the back end apart from APH, the additive protects the Ducts and ESP from corrosion.
- Blue Plume due to SO_3 is eliminated.
- Un-burned carbon can be reduced up to 80% which solves PM emissions and ash disposal problems.
- No Acid Smut.
- No frequent boiler outage and undue loss of power.



CLEAN SH

CLEAN APH ELEMENTS

COMBUSTION IMPROVEMENT OF HEAVY FUEL OIL AND VACUUM RESIDUE BURNING POWER PLANTS

Boilers which require better combustion and substantial particulate reduction have the following treatment options:

A. Combustion Catalyst

B. Water-in-Oil Emulsion (WIO)

In the case of WIO Emulsion the secondary atomization facilitates burning of more unburned carbon reducing it up to 60 – 80%. The NOx reduction achieved can be up to 15%.

This application solves to greater extent ash disposal problems which has no commercial value. This satisfies the local environmental agency norms in solid waste disposal and Particulate Matter reductions from the stack emissions.

Dual Fuel Additive Treatment:

In the case application of CC or WIO Emulsion, the Vanadium, Sodium and Sulphur present in the oil are to be additionally treated with Magnesium based additive to fight the hot and cold end corrosions.

ADVANTAGES OF WIO COMBUSTION IMPROVEMENT PROGRAM

Our WIO Emulsion Additive combustion Improvement Program uses stable, water-in-oil emulsified fuel which provides improved combustion, cleaner operation, and higher efficiency than conventional No. 6 fuel oil and the vacuum residue.

Secondary Atomization: Emulsified water droplets contained in every atomized fuel droplet rapidly vaporize and expand in the combustion chamber, shattering the oil into many smaller droplets for faster, more complete combustion.

Better Carbon Burnout: Smaller fuel droplet size means more complete carbon burnout and lower particulate emissions.

Lower Peak Flame Temperature: Our Emulsified Fuel lowers the peak flame temperature which in turn reduces NO_X formation.

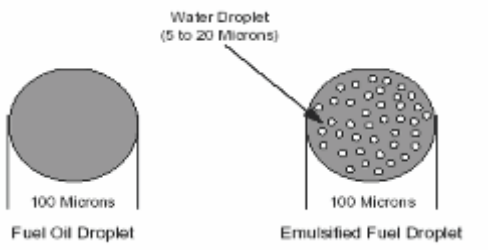
Less Excess Air Required: Our Emulsified Fuel can be burned cleanly at lower excess air levels, reducing the formation of SO_3, NO_X and low melting point vanadium oxides.

More Compact Flame: A more compact flame increases the gap between the flame envelope and boiler walls, which in combination with high melting point ashes, allows molten ash to solidify before reaching the boiler tubes.

Reduced Slag Deposits: The more complete combustion provided by our Emulsified Fuel keeps boiler surfaces clean longer, allowing better heat transfer and less maintenance.

The emulsions achieve smaller droplet size by a phenomenon known as "secondary atomization". When this fuel enters the combustion chamber, it is atomized to approximately 100 micron sized droplets. However, the emulsified water within each drop of oil flashes into steam, exploding the fuel into thousands of smaller droplets.

Photomicrograph of dispersed 5-20 um water droplets in fuel oil



STACK 2: BEFORE WIO TREATMENT
STACK1 & 3: AFTER WIO TREATMENT
(Similar results can be achieved with Combustion Catalyst)

WIO EMULSION FIRED ASH (NO BLACK PARTICLES)
(Similar results can be achieved with Combustion Catalyst)

NB: *Treatment with Combustion Catalyst will give upto 40 - 60% reduction in Unburned Carbon and it does not require an Emulsion Skid.*

MAGCARE GAS TURBINE FUEL OIL ADDITIVES

Gas Turbines burn HFO, light crude or heavy. Since these fuel oils are not refined, these contain a number of impurities contaminated with vanadium and other metal compounds. Heavy fuel oils contain many metallic contaminants of organic and inorganic compounds, which may include sodium, potassium, vanadium, lead and nickel which interact with oxygen and Sulphur during combustion, including oxidation in the combustion plume, to form reaction products, including low melting point oxides. Metal and ash contained in the crude and residual fuels can cause corrosion, erosion and fouling. Sodium and potassium are conventionally removed prior to being injected to the combustion chambers by using an upstream fuel oil treatment system with the aid of electrostatic separators or centrifuges. However, elements such as vanadium and lead are not water soluble and are difficult to remove from the fuel by using any upstream process and Corrosion due to these elements treated by applying vanadium inhibitor. Frequently turbines and compressors are washed offline to remove the ash deposits. This washing is done when rated output and heat rate degradation happens due to fouling.

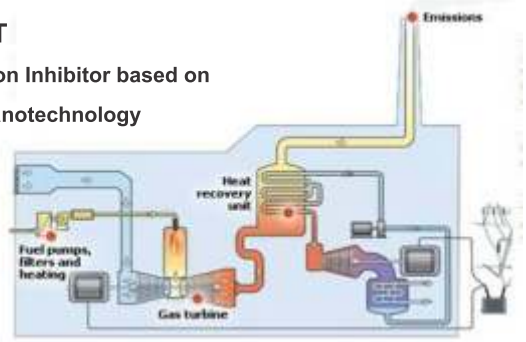
Ash deposits build-up on the hot gas path airfoils for gas turbines operating with HFO, turbine efficiency drops due to increase in surface roughness and decreasing nozzle throat areas. This loss of turbine efficiency results in a gradual drop in firing temperature, effectively magnifying the performance loss due to fouling. This necessitates maintaining the control of firing temperature.

Problems due to vanadium corrosion are addressed by applying Magnesium based Organic fuel oil additives. MagCare will suppress hot corrosion in the Gas Turbine and reduce down time and damage to the walls of the plant and avoid corrosion of flue system enabling a reduction in heat losses.

OUR CONCEPT

Vanadium Corrosion Inhibitor based on

Our Proprietary Nanotechnology



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- Vanadium Corrosion Inhibitor has a large specific surface area making it highly active. MagCare prevents Vanadium Corrosion as it enhances reacting with Vanadium compounds & other impurities to form low melting inorganic salts which deposit as a viscous liquid.
- The fire residue is very little. Scale depositsare very easily washed away.
- SO3 content in the smoke reduces drastically! Sulphuric acid dew point corrosion is also reduced in the Boiler part at low temperature.

Our MagCare Gas Turbine Oxidation Catalyst can reduce the Particulate Matter to World Bank guidelines of level of 50 mg/Nm3.

MagCare is an oil soluble liquid and it can easily be metered directly into the fuel handling system. The dosage rate is dependent on content of vanadium, sodium and Sulphur.

MagCare acts as an inhibitor to accomplish the following:

- Conversion of corrosive compounds in the hot gas path into high melting point frangible salts that permit higher firing temperatures.
- Reduction of the volume of ash generated by using higher valence compounds that form denser reaction products, leading to longer time intervals between water wash cycles.
- Driving lead to form lead sulfate instead of a corrosive oxide and
- Driving nickel to form nickel sulfates so that nickel constituents in the ash are become water soluble.

Features and Advantages:

- Highly reactive sub-micron oil soluble fuel additive.
- Eliminate disintegration of organic sludge in fuel tanks of the refinery, the fuel trucks and the tanks in the plants.
- Reduce fouling in gas turbine and recovery boiler.
- Neutralize vanadium deposits and corresponding corrosion effects.
- Reduction of maintenance time.
- Improve combustion of the fuel with catalyst action.
- Reduce waste water generation.
- Inhibits high temperature corrosion of Furnace, Super Heater and Re-heater Tubes.
- Modifies Gas Turbine / Process Heater Fly Ash
- Lower Acid Dew Point of Exhaust Gases.
- Reduces Boiler Plant Cold-end corrosion.
- Prevents formation of low melting deposits of vanadium and sodium.
- Neutralises acid forming SO2 and So3.
- Maintains efficiency of Gas Turbine and promotes operational economy through improvement in cleanliness, reduced down time and reduced thermal losses.
- Extends Gas Turbine operation, periods, and Gas Turbine availability.
- Promotes the formation of powdery friable fireside ash.

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