

Implementation of Nano Composite Material in Oil and Gas Industry

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Abstract: Magnesium alloy, the most favorable compound in the field of Science and Engineering. The Magnesium Alloy having Low-Density and High-Strength showed record levels of Specific Resistance and Specific Module in Both Low and High Temperature. Lighter than all Engineering Materials. A silicon carbide is a highly hard ceramic commonly used in industrial cutting blades. The Combination of these two Materials has brought a Magnesium Nano-composite with a 'Record Breaking' Strength to Weight Ratio. This Magnesium based Material, composed of 86% of Magnesium and 14% of Silicon Carbide particles, invented by the researchers in University Of Applied Sciences in Los Angeles. This material said to be the World's Strongest Metal with extreme Lightweight. In the Field of Oil and Gas, extraction of oil done by a process called drilling, which plays a vital Role in the extraction. This Abstract Deals with the implementation of this Magnesium Silicon Carbide in the upstream and midstream of oil and gas industry, for an effective and cost-efficient way of extracting and producing Oil and gas. For Example, The Drill Bit used in the current Oil and Gas industry is Synthetic Diamonds (PDC), which are Expensive and often does not withstand Temperature above 450° C. The Usage of these Magnesium Alloys is an effective one in this Case. Similarly, Other Oil pipeline, casing construction Process liking casing the well and transporting oil and gas through pipelines with the usage of magnesium alloy metal will be more effective.

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I. Introduction

This paper mainly entertains an idea that deals with the implementation of Magnesium Silicon Carbide a Nano composite material in the process of upstream and midstream oil and gas industry, for an effective and cost efficiency way of extracting Oils. Extraction of oil and gas resources from the subsurface reservoirs is a tedious process. Where there is a need of highly heavy tools and equipment should have been manufactured using strongest material in the world. The upstream oil and gas industry contain many sophisticated and high usage tools are made of silica. This research paper will give a precise information about an idea and process how a newly discovered nanocomposite material should implemented in the oil and gas industry.

II. Nano Composite Material

A composite is a combination of two or more different materials that mixed with an effort to blend the best properties of both. When we ought to know a group of engineers from university of California claimed silicon carbide nanoparticles along with magnesium with high hardness to weight ratio, which found to be far greater than other strong metals. As we know Magnesium is the eighth most abundant element and constitutes about 2% of the Earth's crust by weight, and it is the third most plentiful element dissolved in seawater the chief use for the metal is as an alloying agent to make Productive Materials. Since magnesium is less dense, this alloy prized for its properties of lightness combined with strength.

Magnesium known for the lighter structural metal in the industry, due to its low weight and to its capability of forming mechanically resistant alloys.

Magnesium used to create super-strong yet lightweight materials and alloys, for example, when infused with silicon carbide nanoparticles to gain extremely high specific strength Magnesium reacts slightly or will never react with Alkaline or Earth Alkaline Metal. It can blended by sintering to form very hard ceramics that are widely used in applications requiring high endurance. Silicon carbide not attacked by any acids, alkalis and even molten salts up to 800°C. Silicon carbide ceramics with little grain boundary impurities maintain their strength even at very high temperatures, while facing 1600°C with zero strength loss.

III. Magnesium Silica Carbide

Magnesium alloy has been the most favorable compound in the field of Science and Engineering.

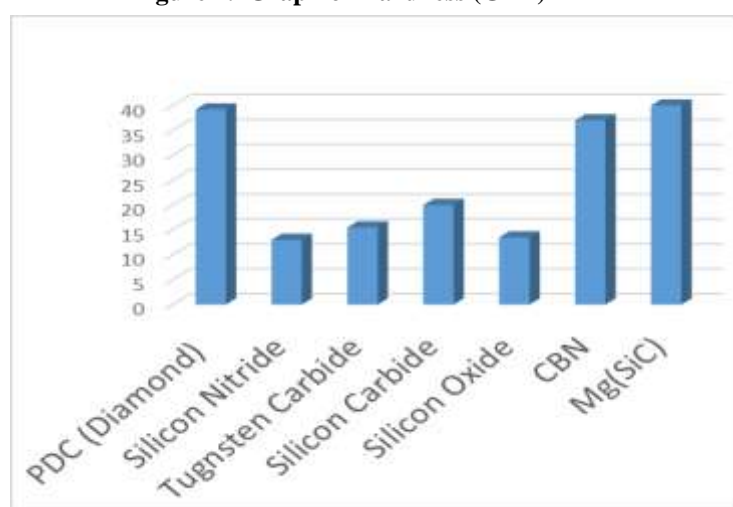
The Magnesium Alloy having Low-Density and High Strength showed record levels of Specific Resistance and Specific Module in Both Low and High Temperature. Lighter than all Engineering Materials. The Silicon Carbide, an Ultra-Hard Ceramic commonly used in Industrial Cutting Blades. The Combination of these two

Materials has bought a Magnesium Nano-composite with high elastic modulus, low friction and hardness among other materials, this Magnesium based Material, composed of 86% of Magnesium and 14% of Silicon Carbide particles, invented by the researchers in University Of Applied Sciences in Los Angeles. This Innovative Material is the World's Strongest Metal with extreme Lightweight.

IV. Nano Composite in O&G Industry

In upstream oil and gas upstream and midstream we currently use Poly Crystalline diamond combat bit to drill hard rocks in the subsurface which is made up of tungsten and silica with diamond coated, based on our research we got to know magnesium silica carbide a Nano composite material has much better property then the existing one. It would be highly efficient, if we replace PDC by magnesium Nano composite material, as it will be a cheaper one when we compare to PDC and it will be more effective in case of efficiency. Casing is large diameter pipe, assembled and inserted into a newly drilled section of a borehole and typically held into a place with cement. The currently used Pipes Are Stainless Steel. A Casing Usually Prevent contamination of water sand. Stainless steel is used where both a certain resistance to corrosion and other of its many superior properties are required.

Figure 1. Graph on hardness (GPA)



V. Casing and Pipelines

In casing there are two main problems which is still in existence is while drilling the cuttings used to hit the casing in high force where in some cases it uses get damage and in other circumstances, it damaged due to heavy shocks of drill stem of heavy loads. The next problem is during the production of oil and gas from the reservoirs it use to form scale in the inside of casing which in turn hinders the production of the well due to presence of many heavy and scalable components in the formation fluid. In order to come across these problems a good solution would be implementing magnesium silica Nano composite material in case of the existing stainless steel in casing. Because the proposed material has good tensile strength, hardness, and high thermal conductivity when compared to the existing material. That too the proposed material is cheaper and highly cost effective when compare to the existing one. In Pipeline it is more important is to avoid corrosion because it faces the surface condition that too for a long time. In existing pipelines it often gets corrode and there is formation of scale in inner side of the pipeline again the good solution would be the usage of proposed material. When implementing the proposed material in both casing and pipeline the Nano phase will be applied only inner side of the casing as we know a Nano composite wont exhibit friction so there will zero percentage of scale formation in the inner side of the casing and pipeline. Whereas the outer surface will be a normal one so that it can exhibit friction to overflow substance in casing and pipeline.

Table 1. Relation between existing and proposed

Stainless Steel	Magnesium Nano Composite
They are corrosion resistant	They are better corrosion resistant when compared to the steel
Involves composition of various metals and compounds	Composed of magnesium and silica carbide particles.

VI. Drill Bit

While drilling an oil and gas well number of drill bits are experiences many problems from which the two main problems are erosion of drill bit and losing its hardness. The drill bit erosion is mainly due to the scratches created by the drilled cuttings from the well this is due to the heavy drilling rate the drilled cuttings used to come up and hits the drill bit in high pressure which in turn creates friction with the drill bit and causes erosion in its surface. The next problem is losing its grading frequently in a single well that too in short span of time, which in turn make way for replacing the drill bit, it consumes more time for trip in trip of the drill stem. This major cause is mainly due to the manufacturing defect, it also reduces the drilling rate during its early stages. This is mainly due to lack of strength and hardness in the manufactured material, as we know drilling industry currently use tungsten as the main component of the drill bit with shaded diamond that too it can tolerate only up to 300C but the real demand is more than 450C. Because the average maximum temperature recorded in oil and gas well are 450C this is the main reason for the above problem.

Table 2:- Relation between PDC and Nano Composite

PDC Drill Bit	Nano Composite Drill Bit
They are corrosion resistant	They are better corrosion resistant when compared to other bits
Involves composition of tungsten and diamonds	Composed of magnesium and silica carbide particles.
Highly expensive	Cheaper and high efficient compare to the PDC.

VII. Conclusion

In this highly sophisticated heavy industry, the need to solve problems is more essential which in turn increase the production and satisfy the needs of many countries. The above research could be a better solution for the mentioned problems and even for other parameters the usage of magnesium Nano composite material which can be a highly effective one. In order to overcome the better combination of composition while manufacturing the different tools based on its need is important to have good knowledge about Magnesium Nano composite material.

While implementing for similar tools following points that should kept in mind are:

1. Have a precise look on the temperature of Nano composite based on its composition.
2. Elastic modulus is really import in pipelines, casing and tubing. So have a precise look while manufacturing based on its composition.
3. Hardness should balance with low friction rate for oilfield tools.

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