The use of natural resources and the development of modern technologies

Fossil fuels are the movement of the world. With most of the powerful generations and transport systems that are very dependent on the energy mode. The insatiable need to use natural resources is only growing and flourishing with the development of technology and the advancement of human civilization. Therefore, massive search for the goods led companies to explore it in all corners of the world. The technology for discovering the free resource has been present at the end of the 1800s. The true technological deficit has always been how to recover it.

Borrowing is the most accepted by the receiving method. It brings new challenges and forces us to take a new perspective in the world of electronics. For effective loss one of the most important tools in the sensors. Most of the commercially used sensors are designed to be effective in the environmental environments that supposed to be functional in that, resulting in a disease of specially built sensors for such customized problems. The current wage solutions have a lack of capacity to deal with these unique conditions. The environmental conditions that define the sensor to challenge are such petroleum in hard conditions, one of the many physical influences that effect the sensor is the high temperature.

It has been recorded that temperatures can reach up to 300°C. At the mentioned temperature, a large scale sensor would fuse and cease to function abilities. At this drilling it causes many vibrations, most of the materials in the commercial sensor can be broken because it has never suffered such stress. Given all the problems, we must also remember that corrosion due to humidity under high temperature is also another great thing. Therefore, to design this unique kind, we need to capture our high-level electronic solutions.

Subparts of the Problem

Drawing such a sophisticated sensor at one access is very difficult. Therefore, to treat such a simple set of complexities, it requires that the problem be broken and analyzed. The subdivision of the problems are broken done as:

1. Chip Wafer
2. PCB Substrate Material
3. Packaging (Housing)
4. Joining Technology

Chip wafer

Both conditions of the sensor require the chip to operate at a high temperature at 300°C. The largest COMS, which is available in the market, has the operating temperature range ranging from -50°C to 150°C. It loses all its electrical conductivity at a higher temperature than the range. Since the operating condition for the sensor is at a higher temperature, it is necessary to look for a substitute that works under the mentioned conditions and can also be a mass produced. Mass production is also important because the number of deployments has produced more number of sensors.

PCB Substrate Material

Most of the extra-shelf PCB Substrate Material is made of organic materials such as FR4 & BT. One of the main problems of this type of material is that they are plastic or ceramic of the PCB substrate must have a lot of stress.

Thus, the combination of high temperature temperatures with vibrations makes the PCB substrate, which is an essential piece in the sensor slogan, capable of plastic deformation or breakdown due to its weakness, resulting in the sensor being obsolete. Therefore, the purpose is to find PCB substrate material that can work at work at high temperature and also support vibrations.

Packaging (Housing)

Package is the main protection of the electronic circuits of the operations, an electronic chip must suffer. One of the key parts of this defensive device is the housing of the chip. Most commonly used residual materials are usually ceramic or glasses in nature. Therefore, as mentioned above for oil-piercing sensor, which has to endure vibrations, a ceramic package is useless.

Therefore, due to the smooth operation of the sensor, it is necessary to find material that can not only support vibrations but have the capacity to stand at its high temperature structure. It should also have a thermal expansion, which is similar to the materials of the PCB substrate. Because if the thermal expansion sensor does not work so.

Joining Technology

Joining technology is an important part of the micro-electronic circuit construction. It is like the cement of the entire electrical component building. The main component of joining all the components is solving. Soloist is used to unite all the components of the micro-circuits. Therefore, it has a great influence on the action of the sensor itself. The temperature of the environment is a challenge to choose a solution of alloy that has the capacity to resist the heat and to expand it with all other components to keep the sensor function free. All common soldiers who are free cannot resist the temperature for petroleum. Therefore, the objective is to find a solid alloy that not only resists the temperature, but also the expansion that should be similar to the PCB substrate material. By adding this, it should also be conducted free of charge for environmental reasons.

State of the Art

Oil loss can be deemed classified in two, based on the range of deep oil found in good temperature. This includes a low temperature loss in which temperature incorporates 150°C to 170°C temperature neighborhood and high temperature perforation in which temperature exceeds 200° C.

The state of Art of these electronics finds its origin of the traditional pure multifunctional epoxies for PCB material in High-temperature waste oil and gas control tools, which is the pressure temperature tool just demonstrated by Sandia National Laboratories. This tool uses the technology of high-temperature silhouette-on-insulator (SOI) device, qualified for continuous service at 225° C for 5 years. Schlumberger has also developed a complete solution for the electronics that can work with a greater expectation in 200° C, using electronic technologies of ceramics. The general idea is that none of these solutions have evolved considering a frictionary temperature of up to 300° C. The art is considered to have a high temperature up to 225° C and this does not occur with the task at hand, which brings the possibility of frictional temperature reaching 300° C. As a result, it is clear that no existing research was carried out on the general electronic assembly in that temperature district. That is, because in this task, using a cooling system is impossible due to space limitation. Also, ceramic material-selection, which could be the best option, is also impossible due to heavy vibrations and friction temperatures up to 300° C before the ceramic must be broken due to its dirt. As a result, it is necessary to go further on research to obtain a suitable electronic assembly that can work for a limited time in the conditions.

The Position of the Electronic Sensor on the Drill Bit.

Electronic components were protected from high temperature, surrounding them in a thermal mattress called Dewar. However, Dewar in a hot well will eventually allow the components inside to the point where they may fail. Decision provide only temperature protection and are expensive and weak and this makes it unsuitable for application in the proposed task.

Cost Ratings of the PCB substrate materials

The choice of a PCB material would involve the typical trade-off of cost and performance and in the final analysis would probably involve a combination of several design options. Samples of the basic PCB design (50 square inch 2-layer PCB with a bottom plane as a heat dissipater), were investigated and the cost performance options and yielded this table below

Market cost of PCB Materials. 3: Preferred Solution

Firstly, it is necessary to briefly state that the selection of these materials for the task is a function of the Material. They include Dielectric Constant (DK), Coefficient of Thermal Expansion (CTE), Intrinsic Carrier Concentration (ni), Glass Transition Temperature (Tg), Flexural / Mechanical strength etc. It will also be interesting to know that the frequency of signal transmission should also be considered because the electronic assembly sends geothermal signals in real time to the database where it is used to control the drill direction.

For the PCB Material Selection

State of Art:

- FR4 epoxy material for low temperature drilling up to 170°C / 180°C.
- Excluding Ceramic substrates due to heavy vibrations. Solution:

The Polyimide substrate with Glass Transition Temperature (Tg) of 260°C can be made to work at 300°C neighborhood for a limited time a sustainable solution which can then be improved by Insulated Metal Substrate technology (IMS) using Cu / AI base for effectiveness at higher temperature

> 300°C. This IMS technology makes the polyimide material 8 to 10 times more thermally conductive than the FR4.

Relative Dielectric Constant vs Frequency for Several Limited Types.

It has greater flexural strength, low dielectric among other advantages over FR4. As a result becomes a good solution for the PCB material for the electronic assembly. It is important to control the moisture exposure of the Polyimide materials because of its moisture absorption readiness property. This polyimide PCB type material have been implemented in the field and have been found appropriate for application in the down-hole Oil and Gas companies.

Capabilities of High Temperature Technologies

Solution

Silicon on Insulator (SOI) technology can be used to operate at 300°C neighborhood due to poor device isolation and lack of reliable Silicon connections over 250°C. Silicon Carbide (SiC) is preferred at a temperature greater than 300°C neighborhood for reliability in longer application due to its high band gap, low dielectric, high mechanical strength, high heat conduct, etc. But due to cost considerations, SOI recommends for limited time.