

## Fire Extinguisher based on Graphite powder for Extinguishing Fire in Fire Work Industry

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**Abstract-** This study discusses about the issue of security of workers safety in fire work industries and the surroundings of fire work industries. It is intended to aid in the security of the fire work industries by bringing new and alternate type of fire extinguishers. These fire extinguishers developed are not just the normal extinguishers, because in this study graphite is used as an inlet for the fire extinguishing equipment, which has 3600°C as boiling point and the only component which have more possibility to extinguish the metal fire. Graphite based fire extinguishers specially made for fire work industries. Graphite based fire extinguisher cannot be used for electricity fire because of graphite is an electricity. It is the connecting component for pressure of the cylinder nitrogen gas which use the graphite. Nitrogen gas with 13 bar pressure is used in this extinguisher. Also some other extinguishers contain foam, dry chemical powder, carbon dioxide and water. Here graphite is used for the better performance, change of pressure and gas also helps to improve the quality of fire extinguishers. This project brings to limelight an alternative safety system for firework work industries fire extinguisher.

**Index Terms:** Fire Extinguishers, Graphite, Nitrogen gas, Fireworks, Fire and safety, Metals, Fire

### Introduction

An explosion is said as a sudden increase in volume and release of high amount of energy in a rapid and violent manner, with the generation of high temperature and release of flame and hazardous gases. Explosion is a chemical reaction of any chemical compound /mixture, when initiated, undergoes a very rapid combustion or decomposition releasing large volume of highly heated gas that exert pressure on the surrounding medium. Thus, the sudden conversion of chemical energy into kinetic energy with the release of heat, light and mechanical shock causes abrupt destruction. An explosion in a building generates four types of loads viz. impact of primary fragments, impact of secondary fragments, overpressure, and reflective pressure. Primary fragments originate from the source of the explosion, secondary fragments consist of objects that are picked up and thrown once the explosion radiates. This can include equipment or other objects that are not properly secured to the ground, bricks from unreinforced walls, or portions of the structure itself. Primary and secondary fragments are both associated with significant casualties, but in certain cases it also contributes to major structural damage or loss of plant and infrastructure.

Explosives can be broadly classified into two groups viz: Military and civilian or commercial. Military explosives

include bombs, mortar shells, bullets, etc. Also explosives are designed for a specific form of delivery. They are generally uncased explosives (various plastic explosives used for demolition and other functions) and referred to as high explosives. Low explosives such as propellants are also being used. Examples of commercial explosives are Dynamite, TNT (trinitrotoluene) and Ammonium Nitrate construction. Pyrotechnic mixtures are energetic chemical compounds susceptible to explosive degradations on ignition, impact and friction. The Explosives Act, 1884 is a comprehensive law regulating the manufacture, possession, sale, transportation, exportation and importation of explosives in India. Based on this act, Explosives Rules 1983, Gas Cylinders Rules 1981 and Static and Mobile Pressure Vessels Rules 1981 were framed to prevent accidents at various points of handling of explosives in India.

### Dos and Don'ts of fireworks

When using fireworks, the following advice are to be followed

- One should never play with fireworks. Because Fireworks are explosives and can hurt..
- Only fireworks marked BS 7114 are to be bought.
- Only adults should light or hold fireworks.
- When one person are watching fireworks, stand well back.

## “Fire Extinguisher based on Graphite powder for Extinguishing Fire in Fire Work Industry”

- Keep fireworks in a closed box.
- Follow the instructions on each firework.
- Light them at arm’s length, using a taper.
- Never go near a firework that has been lit. Even if the fire extinguisher hasn’t gone off, it could still explode.
- Fireworks will frighten the pets, so keep the pets safely indoors.
- Never put fireworks in the pocket or throw them.
- Supervision of children around fireworks should be done.
- Light sparklers one at a time, always wear gloves and hold them at arm’s length. Never give sparklers to children under five. When your sparkler goes out, Don’t Touch it. It could still burn, so put it hot end down in a bucket of water made ready for this purpose.
- Do not drink alcohol if setting off fireworks.

Planning Ahead Running a display takes a lot of work, so try to share the load by planning ahead.

- Set up a committee for the members can each take responsibility for a particular task (including one person to be in charge of all safety arrangements).
- Be clear on who will do what and when.
- Be sure each member has a photocopy of this guide and follows its advice.
- If possible, try to recruit at least one person with previous experience of firework displays.
- Remember – fireworks not marked with ‘Complies with BS 7114 Part 2 1988’ are only suitable for use by professionals. Contacting the Right People
- It is very important to keep the authorities informed of your plans.
- November 5th is always a busy time for them, so please give them plenty of warning about your plans.
- One should contact When there is a fire explosion are
  - The Fire Brigade
  - The Police
  - First Aid Service
  - Local Authority

When there is an explosion one should contact the Local Authority, Police, Fire Brigade and First Aid organizations, the appropriate team member should:

- Arrange the fireworks to be delivered and stored securely (and circulate the manufacturer’s general instructions to team).
- Animals can be terrified by fireworks. Warn the neighbors and any local farmers in advance so they can keep pets indoors and take other necessary precautions.
- Arrange for you and your team to be trained in the various tasks for the night, including all emergency drills.
- Arrange for first aid posts to be staffed by qualified people. Borrow or hire special clothing (bibs, jackets etc) to identify the team on the night.

- Arrange some form of public address system – as a safety measure, not just for commentary. A loud hailer will do as a bare minimum.
- Arrange for fire extinguishers, buckets of water, buckets of sand and metal litter bins to be available on the night.
- Check that plenty of electric torches will be available on the night, with full batteries.
- Publicize the fact that spectators are not allowed to bring their own fireworks (including sparklers) and will not be admitted if they do so.
- Prepare all necessary signs.
- Make absolutely sure that enough people available to help on the night (including some cover for illness). Draw up a detailed checklist of tasks and indicate who is to be responsible for each one.

### Methodology of the present work.

This invention connects to graphite containing fire extinguishing compositions for use only for metal fire like

1. Aluminum
2. Potassium
3. Zirconium
4. Magnesium
5. And it’s alloys

More specifically, this study relates and concerns only on fireworks, this graphite based fire extinguishing composition which can be stored in the container and expelled from the container by nitrogen gas under pressure.

### Comparision

Common Fire Extinguishers	Graphite based Fire Extinguisher
<b>Inlet:</b> <ol style="list-style-type: none"> <li>1. Foam</li> <li>2. Dry chemical powder</li> <li>3. Carbon dioxide</li> <li>4. Water</li> </ol> <b>Pressure</b> 15 psi	<b>Inlet:</b> <ol style="list-style-type: none"> <li>1. Graphite 10<sup>-9</sup> nm</li> <li>2. Nitrogen gas for pressure</li> </ol> <b>Pressure</b> 13 bar Pressure inside container

The size of the graphite inlet must be in the nano size-10<sup>-9</sup>m. The change in size of graphite particle will change the nature of output (extinguishing capacity) and the character of extinguisher.

By using 10<sup>-9</sup>m sized graphite,

1. Slows down fast neutrons and scatters thermal neutrons.
2. It lowers the co efficient of thermal expansion.
3. It will break the fire chain easily.
4. The pressure 13 psi tells the container to maintain the capacity of graphite

### Materials

1. Extinguishing Agent-Graphite powder
2. Valve Assembly
3. Container
4. Nozzle container containing Extinguishing agent and Propellant

### Methods

- The graphite is crushed with the help of ball mill, the particle size of the graphite must be nanometer. For that Graphite powder was grinded well and sieve shaken to separate from other sized particles
- After grinding the graphite, structure and size of the particle must be analyzed using sieve analysis
- Changes in particle size will affects the output of extinguisher
- For maintaining the pressure inside the container Nitrogen gas is used
- Pressure has to be maintained in respective amount

### Conclusion

After referring the survey, the idea is to get to understand more about accidents and unsafe conditions of fireworks. So it is decided to invent this type of fire extinguisher particularly for those fire work industries. There is a hope that this project reduces the accident rates of fireworks.

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