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THERMOCHROMIC INDICATOR

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ABSTRACT

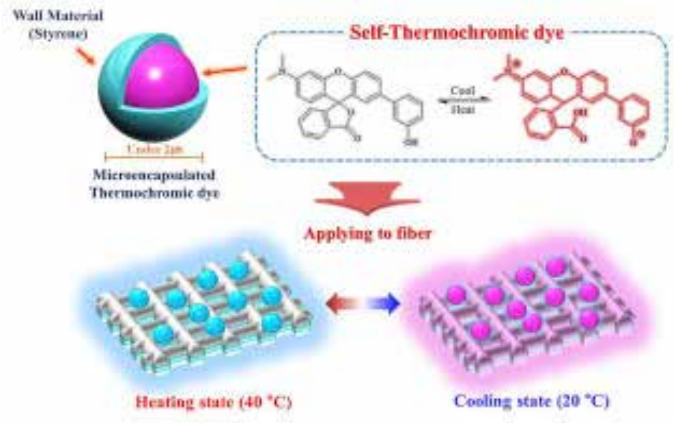
This paper presents an integrated design of hydrocarbon fire proofing summed up with Thermo chromatic indicator. The application of the same is outlined for the quick remedial measure to the initiated cause of the fire mainly in Industries and Plants. It basically works by the application of thermo chromatic dye which changes its color when comes in contact with specified temperature change which spots something unusual taking place on or near the equipment which can be easily monitored by the fire department officials on duty supervising the safety of the Plant or Industry. This mainly aims to cut down the high rising costs of instalments of fire monitoring devices like heat detectors, smoke detectors etc by replacing them with the newly designed thermo chromic indicator.

I. INTRODUCTION :

Conventionally this has been observed that the basic fire detection methods includes the use of smoke detectors, heat detectors etc having high cost of instalments and sometimes a complicated working too. But now by the help of our newly introduced design of fire detection system which works on the principle of thermochromism shatters down the installation cost as well as makes the conventional complexes the simpler ones. Thermochromism is a reversible change in the color of compound when it is heated. The physical background of thermochromism and the state of development of thermo chromic polymers based on light absorption and reflection properties is used. Since we know almost every thermo ionic compounds are unstable at extreme temperature conditions that's why we have used a high thermal conductivity ma terial that is copper rods which helps in transferring the heat from the source to the indicator sur face which consists of a compound mixture of Copper Sulphate with 10% of HCL solution which in turns via alteration of its color indicates about the fire source. In this we have also used the concept of fire proofing wall with the help of suitable hydrocarbons as discussed.

II. THERMOCHROMIC INDICATOR AND HYDROCARBON FIRE PROOFING :

1. Thermo chromic indicator is mounted over the copper plates which are the connecting links between thermo chromic indicator and the desired equipment surface coated with hydrocarbon layer for fire proofing.



2. The hydrocarbons fire proofing coating over the desired equipment is used for specify protection as this prevents the surface from heating up rapidly and delays the loss of load bearing capacity. It consist of solvent free epoxy intumescent coating.

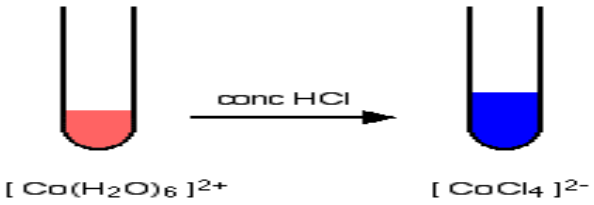
III. PREPARATION OF HYDROCARBON FIRE PROOFING WALL :

3. It is prepared by the abrasive lasting to SA2 according to ISO8501-1 and applying a layer of PBG SIGMA COVER 522 primer 275200 microns.

IV. PREPARATION OF THERMOCHROMIC INDICATOR:

4. The reaction governing this indicator is a reversible reaction. It involves the change in coloration from pink to blue. The compound mixture consist of copper sulphate and hydrochloric acid solution which in the presence of high temperature gives blue color indicating the source of fire hazard. The simplest expression of it can be easily understood as follows:

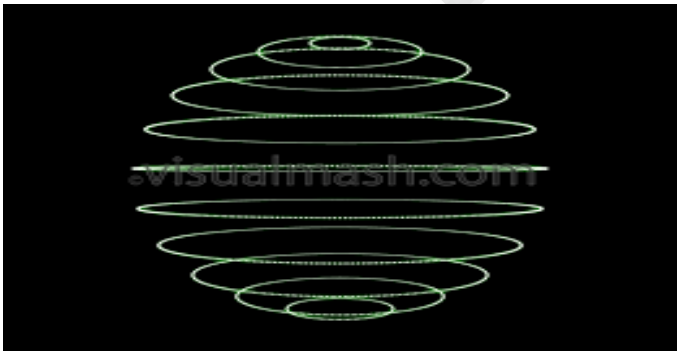
(In the presence of high temperature)
$CoSO_4$ [100 mg] + 10% HCl solution (pink colouration)
$CoCl_2$+H2SO4 (blue coloration)
CoCl2 + H2SO4 (blue colouration)



V. WORKING :

*At the working temperature of the respective equipment or machinery in the plant or industry the thermo chromic indicator(mounted over the copper plates in the form of circular loops) will remain non-functional but at the same time if it gets any unusual heat source at the time of fire incident, the copper plates connects the link of heat transfer to the indicator surface(due to its high thermal conductivity) it completes the circuits and on the exposure of the high temperature the installed thermo chromic indicator involves itself into a reversible reaction and in turns gets its color changed indicating the fire incident ongoing at the respective apparatus or machinery and marks the notice of the fire officials on duty about the same.

Here the below figure represents horizontal strips showing the position of thermo chromatic indicator.



VI. CONCLUSION :

From the very conventional methods of fire safety this method has been designed in order to give a new definition to fire detection. From the very research made on the indicator it has been concluded that the use of thermo chromic indicator can be proven to be the simpler and economical method for the tackling of the rapidly growing fire incidents in the plants or industries.

VII. ADVANTAGES :

Some major factory fires and explosions, 2011–2013

Date	Location	Industry	Incident type	Number of deaths
13 Apr. 2013	Texas, USA	Fertilizers	Explosion	15 (160 injured)
24 Nov. 2012	Dhaka, Bangladesh	Garment making	Fire	112
11 Sep. 2012	Karachi, Pakistan	Garment making	Fire	289
11 Sep. 2012	Yegoryevsk, Russia	Garment making	Fire	14
11 Sep. 2012	Lahore, Pakistan	Shoe making	Fire	25
5 Sep. 2012	Sivakasi, India	Firework	Explosion	37 (60 injured)
25 Aug. 2012	Paraguaná, Venezuela	Refinery	Explosion	48 (151 injured)
6 May 2012	Rayong, Thailand	Synthetic rubber	Explosion	12 (100 injured)
20 Nov. 2011	Shandong, China	Chemicals	Explosion	14
17 Oct. 2011	Raidighi, India	Firework	Fire	42 (11 injured)
17 Jan. 2011	Wuhan, China	Garment making	Fire	14 (4 injured)

Hazardous sectors

- Its a simpler and economical way for fire detection.
- Maintainance is easy (just requires application of indicator coating on adequate intervals).
- Can be made into use for different apparatus or machineries based on thermal stability of the chromic indicator used as per different temperature conditions.
- Use of hydrocarbon fire proofing walls in combination with thermo chromic indicator makes this very design more productive and efficient in terms of fire controlling.
- Can be easily spied through cctvs,or cameras at surveillance.

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