COMPUTER AIDED FIRE SAFETY SYSTEMS IN CHEMICAL INDUSTRIES

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Dear Colleagues,

I would like to speak about 5 probably different items, but I think, important works connected with computer aided problems of safety in modern plants. If this kind of manuscript is not acceptable I will make a necessary corrections immediately.

I will be grateful for any notation.

Numerous experimental and theoretical researches have shown, that the most effective, frequently a unique means of study of emergencies and the substantiation of safety serves mathematical (computer simulation). Computer simulation actuality of complex of fire- and explosive risk manufactures (large gaze-oil refining complexes, chemical-technological manufactures, Power Nuclear Stations, etc) [1-3] is increasing just in the given moment of our history, when because of an economic crisis in Russia.

Therefore the most rather effective and the accessible method of the research of probable emergency processes remains simulation with the subsequent computer accounts. Thus there is the set of problems, advanced complication of managing systems, creation of the most universal software, "manufacture - person" is optimum for system. In accordance with perfection the Computer Aided Systems (CAF) for technological objects grows a role of the operator at his interaction with engineering. It is known, that on the average, 60 % of failures occurs on fault of the human factor. Therefore, computer simulation should be directed as on training of the personnel in extreme situations, and on complete automation of an exit from critical modes on an optimum way with the minimum material and human losses. The ideal target is a creation of computer model of "auto pilot" for an industry, efficient as in normal is thus represented, and in emergency operation, when the person psychologically and physically be not capable to solve arising problems.

In the literature [1,2] problems of the risk system analysis, ways of reduction and management by it on fire-explosive dangerous manufactories are in detail examined. Also types of simulation of emergencies are in detail analysed [2]: determinate and probable, simulation on zones and fields. Attempt as much as possible is made to take into account the every possible factors, influencing to development of situations. It is obvious, that direct arithmetic approach increases of number of the equations (even with application of supercomputers) because of impossibility of a fast choice of the correct decision.

The most acceptable creation of software systems as "of artificial intelligence" with use of models "of a black box" is represented. It is necessary to pass from direct mechanical searching of every possible variants to self-learning, constantly analysing development of situations to systems, which by analogy to a human brain accumulate own experience at the decision of typical problems and their actions proceed by analogy to intuition of

high skill expert, which instantly accepts the single correct decision, one should think a few seconds.

All above mentioned details demands creation of non-standard software, perfection of the mathematical apparatus. Also it is very important to research such problems as p*sychology of communication "person – computer", social aspects,* application of high Information Technology (Internet and New Information Technologies) for training and testing employees [3].

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SPECTROSCOPY APPLICATION FOR HIGH RISK INDUSTRIES

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Recently the express - analysis of presumably explosion-hazard substances and environments on firms with the boosted degree of risk and in places of mass residing of the people became urgent. The highly sensitive instruments are applied for this purpose on the basis of spectral analysers in a combination to computer technology. It allows operatively to define quantitative volume of explosion-hazard substances and impurities with exceeding dangerous concentration [1].

Far Infrared Fourier Transform (FT IR) spectral instruments combined with Computer Aided Analysis of obtained data are used widely now. FT IR spectrometers has the sensitivity and the resolution on the order above traditional trellis and lens spectrometers. A recently application of FT spectrometers in infrared (IR) and Far IR (FIR) area of a spectrum was limited to research of metals, semiconductors, two-nuclear gases at super-low temperatures in a reduced atmosphere, where the ratio noise/signal was smallest in relation to a useful signal.

However because of complexity of molecular structure and bad relation a signal/noise there are large problems with recognition of the useful information among statistical noise signals [2-4].

As a result of Fourier Transforming the signals of average and especially weak intensity frequently are poorly distinct in statistical noises. The ways of noise depress for example, multiple obtaining of the same spectrum, summation and obtaining of the

averaged results are known. It allows to cut the equal noise signals, but considerably magnifies time of obtaining and processing of a spectrum, thereof, is inapplicable for express - methods of a control of an environment.

Therefore actually there is a problem of creation of such software for spectral instruments on Fire Explosion Hazards objects, which will allow to define slightest concentrations of dangerous substances in structure of the product (gas, liquid, solid) and to receive necessary emergency measures. In the report the various solutions of a problems are offered.

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NEW LIQUID CRYSTAL APPLICATION IN FIRE-SAFETY SYSTEMS

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In connection with increase of danger of the terrorist acts, technology crashes, originating of fires, thefts there is an acute necessity for perfecting the Computer Aided Safety Systems (CASS). One of directions of such perfecting is the development of more effective means for systems of a Fire-Security Control System (FSCS) on the basis of Liquid Crystal (LC) materials.

LC is a complex composition organic-metal substance having unique properties as of a liquid (fluidity, viscosity, transparency, etc.), and crystal (light and electricity anisotropy, birefringence, sharp sensitive to external actions, etc.). LC materials now are widely applied in instruments of mapping and conversion of the information: displays, screen monitors, optical locks, atteniuatores, etc. In these devices LC have a number of essential advantages in comparison with clones operating other principles of operation - by small energy content (about a micro Watt), small operating voltages (unit a Volt), wide optics region (from infrared up to ultra-violet) etc.

At the same time, the possibilities LC of materials are still fairly from being exhausted. Many of it's properties considered for a number of practical applications as lacks, for example, sharp response to external actions (electromagnetic fields, temperature, infrared, ultrasound to pressure, temperature, chemical impurities, etc.), it can be

effectively used in means of detection for FSCS. Now successes in the field of science and engineering allow by the directed synthesis to create LC materials with defined properties.

Obtained results has shown, that LC materials can be used for construction of fire-security detectors. The fire LC detectors can be used to find out the increase of temperature, appearance of a smoke or products of combustion. A feature is the reaction possibility of one sensitive element simultaneously on some tags of a fire, that considerably boosts operational reliability of the Control System. The security and security-fire LC detectors can react to moving of the man, movement of subjects or opening of a room.

The units of a construction with application of LC materials can also be used for a reliability augmentation of detectors, for example supports of a control of service capability, sensitivity, noise immunity or other functional characteristics.

A few technical solutions on creation of enunciators with usage of features of liquid crystal materials are offered.

FIRE AND EXPLOSION INVESTIGATION BY THE BIOLOGICAL SUBSTANCES THERMAL DECOMPOSITIONS

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The urgent problem is the quantitative estimation of consequences of fires and explosions (definition of temperatures of burning, duration of a fire, the energies and powers of the explosive device, etc.) Aminoacids and Peptides (AP) are making components of all plants and biological systems (including man, animals, etc.). As the organic connections they have the quite defined thermal characteristics: in temperature and energy of burning, fusion, sublimation, decomposition. Therefore, defining chemical structure and the quantity of products of burning or explosion in the given volume, is possible to within degrees or units of energy to determine maximum temperature of burning or energy (power) of explosion.

In this work a new method of a quantitative estimation of burning or explosion with the help of the chemical analysis of products of burning, fusion, sublimation and decomposition of biologically active components on a basis of AP is suggested. The thermal characteristics of the most simple AP are available in a reference media on organic substances. More complex ones also were included in electronic databases or were researched by the author with co-workers in the previous works.

Here the results of researches by methods Differential Scanning Calorimetry (DSC) and Termogravimetric analysis (TGA) of aminoacids and dipeptides, containing aminoacid chains of alanine, alanyle, valine and glicyne are represented. The relative error of measurements was 1 %, accuracy of definition of temperature - 0,5 K.

The analysis of the obtained DSC and TGA data shows, that AP with the linear molecule structure (CH-chains) does not result to conformation changes by temperature increasing. One external CH-group presence in molecule 20 ^{0}C decreasing the relative temperature of fusion and enthalpy in total thermal effect of decomposition. The power contribution of one CH-group is about 6 kJ/mol.

The comparison of the total enthalpy of phase transition for dipeptides with linear and space molecular structure has shown, that for last one the absorbed energy almost twice is more on an absolute value, that is coupled, first of all, with distinction in a structure and difficulties of conformation transformations by temperature changing. Some practical software are suggested for estimation of quantitative fire and explosion characteristics.

RESEARCH OF NEW FIRE AND ECOLOGY SAFETY LUBRICANTS

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The fire- and ecology safety and is one of the most important demands to the industry. In connection with replacement of mineral oils by synthetic flameproof or hard combustible ones is highly typical and actual problem. For the last 30 years in Russia and abroad it has been elaborated many flame-retardant fluids of various types. From offered to industry non-combustible fluids of direct and reverse water-oil emulsion (type HFA, HFB) are braking under long standing and shift in combustible class; ethers of phosphoric acids and silicone fluids (type HFD is expensive, in short supply and often incompatible with packing materials. Most available fluid is water-glycol oils (type HFC), including following components: (a) solvents (water, water-alcohol, -glycol, -glycerine mixtures); (b) additives (antirust, antifoam, etc.): water-soluble

synthetic lubricant compositions (SLC), which are not ignited at a heat, and are decomposed on recycled (ecologically pure) [1-2].

Absorption FT FIR Spectra were obtained by Fourier Transform spectrometer LAFS-1000 managed by the Hardware DVK-3. The work range of frequencies is 80÷550 cm^{-1} , the sample thickness 0.2 mm. Spectra have been recorded automatically from interferogrammes by the inverted Fourier transform method with following software analysis of electric signal parameters. IR spectra were obtained by Specord M80 in range 200 - 4000 cm^{-1}. Viscosimetry was made by standard equipment VPG-1. Substances are of technical grade .

An important new step in our work was an appliance of FT FIR spectroscopy for study these compositions. This field of IR spectroscopy is a most sensitive to texture and conformation and their transformations on supra-molecular level. But FT FIR doesn't define a different small organic molecular parts (excluding metals and

semiconductors).This method allows to define complex texture formations and its changing, which could be created by different compounds. Traditional types of spectroscopy (IR, Raman, UV , X-ray, and etc.) are useable for detailed investigations; the main task is a consequence of these methods for solving certain problems. FT FIR spectroscopy is very useful for research of complex supramolecular structures up to biologic in total without small details which have not important meaning in this case.

Obtained data detect a strong structure stabilisation in two-component system “water - thickener” in concentration range 20-40 % mass. of thickener Structure stabilisation increases in three-component systems on increasing temperature from 25 to 55^{o}C. New structure appears at temperatures 55-65^{o}C at all relations of Pr-186 and 40 % mass. water for all ethyleneglycol quantities.

Also other results are discussing in this work. Obtained new data are very useful for theoretical simulation and the further industry application of these ecology pure materials.

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