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ERRORS OF MODERN STANDARDS AND METHODS THAT MUST ENSURE SAFE OPERATIONS OF NATURAL AND MAN-MADE OBJECTS

Analysis of modern standards, which should ensure the safety of operation of structures and devices and methods based on these standards, showed that the evaluation of the results of experimental studies is carried out with grave mistakes.

1. Testing of pipes for the transportation of oil and gas is carried out according to the standards ASME B31.4-2000 and APY 1104. Modern experimental methods for studying the composition of the structure, the state of the surface of cracks and faults with high accuracy, but the analysis of the results obtained is based on mathematical models devoid of physical meaning. The modern theory of strength and fracture is based on the erroneous hypothesis that the cause of the formation of cracks and fracture is elastic energy, concentrated in stress concentrators. A simple calculation based on modern data refutes this hypothesis

Example 1. One cubic meter of spring steel contains 8.5×10^{28} atoms. The elastic energy accumulated in 1 m^3 at a pressure of 700 MPa is 1 MJ. Consequently, the energy absorbed by a single atom is E = 1×10^6: 8.5×10^{28} = 1.2×10^{-23}J. The bond energy of E_1 atoms is 6.84×10^{-19}J. Therefore, for breaking one bond, the total energy of n atoms is necessary, i.e.

$$n = 6.84\times10^{-19} : 1.2\times10^{-23} = 57200 \text{ atoms.}$$

Such a mechanism in nature is not realized.

2. The fundamental mistake is that any damage is not the cause of catastrophic destruction, because it is itself a consequence of the absorption of energy emitted by local groups of atoms in which energy accumulates.
3. Example 2. Fragment of the standard ASME B31.4-2000. As stated in the standard: The purpose of API1104 is to provide inspection methods to ensure proper welding quality analysis using qualified specialists and approved methods and equipment. This applies to both new construction and welding during operation. This goal assumes that the qualifications of specialists correspond to the level of scientific discoveries.

419.7 Analysis

419.7.3 Basic Assumptions and Requirements

(a) The effect of restraints, such as support friction, branch connections, lateral interferences, etc., shall be considered in the stress calculations.

(b) Calculations shall take into account stress intensification factors found to exist in components other than plain straight pipe. Credit may be taken for extra flexibility of such components. In the absence of more directly applicable data, the flexibility factors and stress intensification factors shown in Fig. 419.6.4(c) may be used.

Flexibility factor *k* by $1+6\frac{P}{E_c}\left(\frac{r}{t}\right)^{7/3}\left(\frac{R}{r}\right)^{2/3}$

Stress intensification factor by $1+3.25\frac{P}{E_c}\left(\frac{r}{t}\right)^{5/2}\left(\frac{R}{r}\right)^{2/3}$

where E_c=cold modulus of elasticity, *P*=gage pressure, *r*=mean radius of matching pipe, in (mm), *R*=bend radius of welding elbow or pipe bend, in (mm), *t*=nominal wall thickness.

As we see the parameters are dimensionless.
Numerical values are proposed without considering any physical laws.

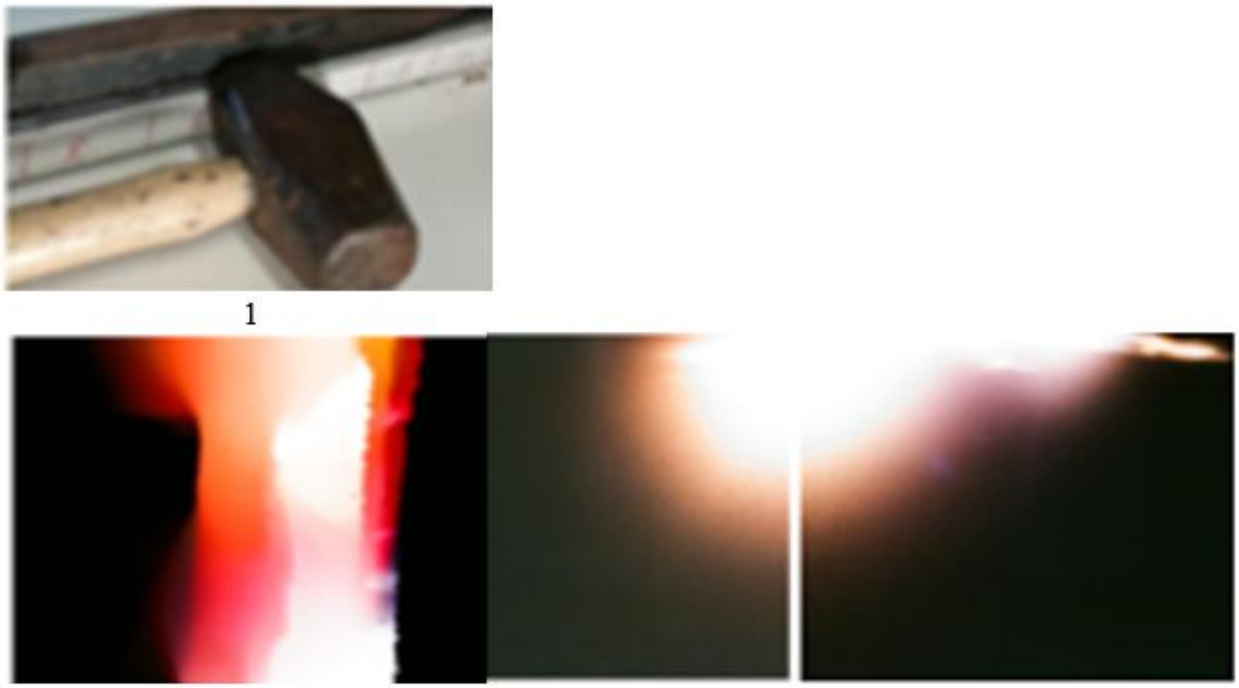
Let us pay special attention to the fact that the deformation of bending and torsion of a hollow cylinder was theoretically solved by J. C. Maxwell in his work “On the Equilibrium of Elastic Solids”, (1850). An experimental verification of the deflection was performed by him to bend rods of iron, copper and glass with an accuracy of three thousandths of a mm.
The second mistake is the role that is attached to the tip of the crack.
However, the main mistake is that the problem of safe operation of structures and devices cannot be solved from the standpoint of classical mechanics.

Let me briefly talk about an alternative solution based on atomic reactions.

X-RAY RADIATION CAUSED IN METALS AND GLASS BY EXTERNAL EXPOSURE

Experimental study of X-ray emission

No	Cause	Sample material	Number of trials	Number of photos	Illustra-tions	No	Cause	Sample material	Number of trials	Number of photos	Illustra-tions
1	Stretching	Al Alloy	4	4	Fig. 1	22	Phase jump	Steam/ Ice	1	18	Fig. 18
2	Stretching	Cu Alloy	4	4	Fig. 1	23	Impact*	Fe Alloy	2	22	Fig.17
3	Compression	Cu Alloy	1	1		24	Impact	Fe Alloy	5	76	Fig. 2
4	Compression	Polymer	1	1		25	Impact	Glass	2	2	Fig. 1
5	Torsion	Cu Alloy	1	1		26	Impact	Flagstone	1	1	Fig. 7
6	Torsion	Polymer	1	1		27	Impact	Wood	1	19	Fig. 2
7	Shear	Fe Alloy	68	68	Fig. 2	28	Impact	Water	1	53	Fig. 9
8	Shear	Al Alloy	25	25		29	Welding	Fe Alloy	3	15	
9	Shear	Cu Alloy	16	16	Fig. 3	30	Corrosion	Cu Alloy	2	2	Fig. 5
10	Shear	Zn Alloy	1	1		31	Corrosion	Fe Alloy	8	8	Fig. 5
11	Shear	Glass	13	12		32	Hardening	Polymer	4	4	Fig. 7
12	Shear	Concrete	2	2	Fig. 4	33	Hardening	Al Alloy	3	14	
13	Shear	Wood	26	2		34	Temperature Gradient	Glass	1	1	
14	Shear	Laminate	16	2		35	Temperature Gradient	Cobble	1	12	Fig. 1
15	Shear	Al/ asphalt	1	40		36	Temperature Gradient	Al Alloy,	3	18	Fig. 8
16	Bending	Silumin	1	1		37	Self-Radiation	Growing pine	1	19	Fig. 9
17	Bending	Fe Alloy	1	1	Fig. 1	38	Self-Radiation	Strawberry roots	2	23	Fig.2
18	Bending	Flagstone	2	13		39	Self-Radiation	Brain	1	13	Fig. 10
19	Bending	Granite	1	9		40	Self-Radiation	Spine	2	18	Fig. 11
20	Bending	Rail	15	234	Fig. 11-16, 19	41	Self-Radiation	Loin	1	10	Fig. 12
21	Bending	Marble	1	11		42	Self-Radiation	Chest	2	29	Fig. 8



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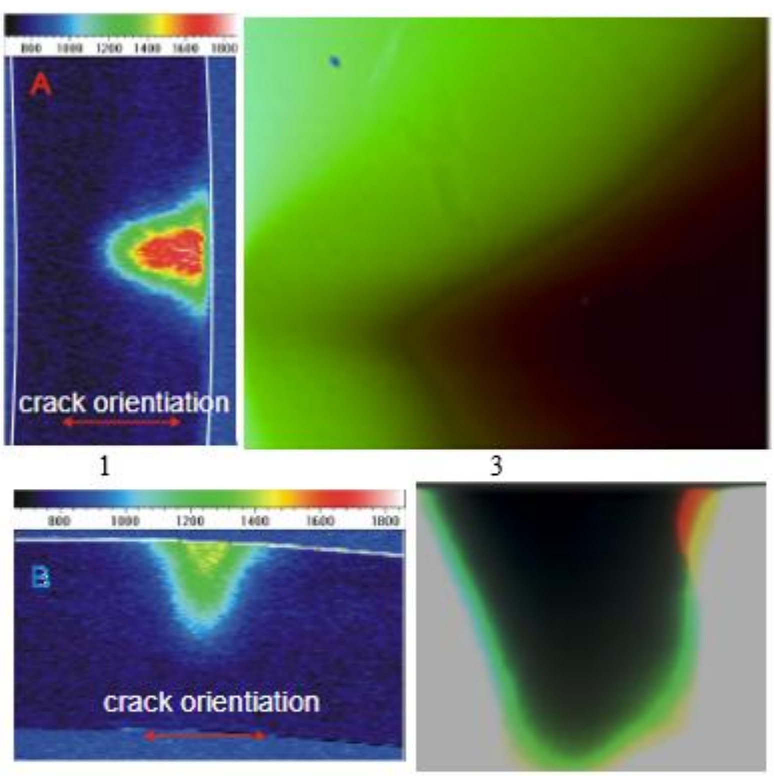
2 3 4

Fig. 1

A photographic film placed in a container that is opaque to visible and ultraviolet rays was placed under a 1.5′ (38mm) thick steel beam, as shown in frame 1.The blow was made with a 4 lb (1.82 kg) hammer on the upper surface of the beam. Frame 2 illustrates the reaction caused by X-rays under the point of impact; Frames 3 and 4 illustrate the reaction at a certain distance from the point of impact.



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Photos 1 and 2 illustrate microcracks in propylene plates

Fig. 2

120 μm thick, 1 × 2 cm 2 in size, detected by small-angle X-ray scattering [J. Schors *et al*. *Non*-Destructive Micro Crack Detection in Modern Materials, ECNDT - We.2.2.2, (2006)]. For this purpose, monochromatic radiation of molybdenum *K* line was used during a potential difference of 18 kV.
Photo 3 illustrates the crack found in the steel beam shown in
Fig. 1, on the absorption of x-rays excited by a blow with the tip of an ax.
Photo 4 illustrates a crack detected in the rail by X-ray absorption excited by braking a locomotive at a distance of 3 meters to it.

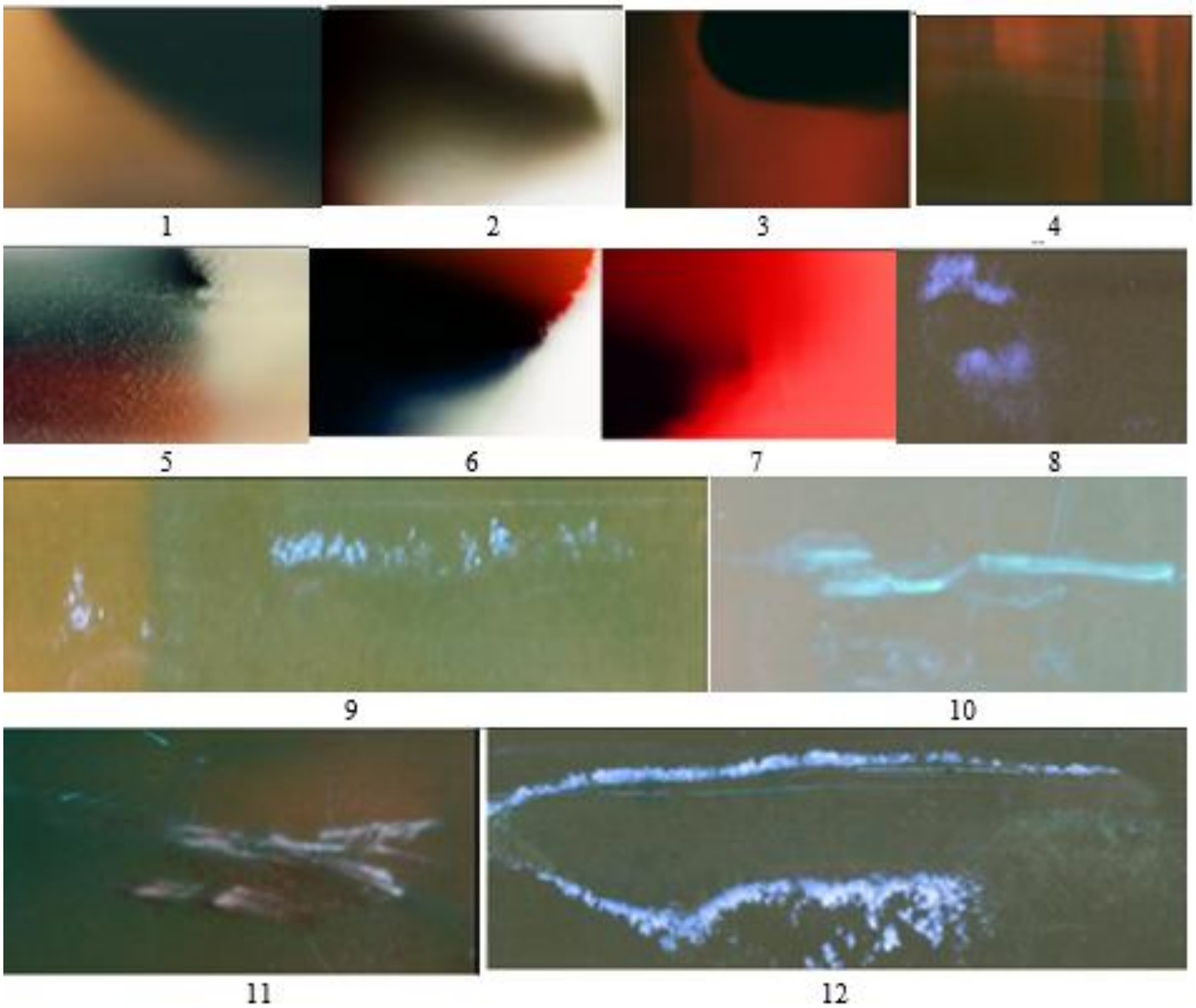

Fig. 3

Photos shown in Fig. 3, illustrate the damage detected by X-ray absorption and radiation excited under the following conditions:
1- a pore or erosion of the rail, found after the passage of the locomotive over this area;
2- crack found in the rail after locomotive removal from 3 m;
3-defect formed in the I-beam after impact with an ax;
4-wedge-shaped crack formed in an aluminum alloy ingot with rapid cooling;
5-defect formed in aluminum alloy at high temperature gradient;

6-crack formed in the cobblestone with a sharp cooling;
7-crack formed in one of the aluminum plates on the connection with the other overlap under tension;
8- crack formed between two parts of a copper plate under tension;
9-copper tube, fixed on the left side, was subjected to torsional deformation; the gap occurred along the line along which the holes were drilled; the luminous areas in the place of attachment and along the center line of the moving part are caused by maximum deformation; the difference in color between the moving and stationary parts is due to the difference in deformation;
10- rod of high-strength steel, fastened to the left and to the right, collapsed into three fragments as a result of the piston movement from above → down;
11- plate made of aluminum alloy, having cuts on the right and left (one of them is visible in the photo), was subjected to tensile deformation, but the experiment was terminated due to the breaking of one of the fasteners;
two cracks formed in a glass plate cooled with liquid nitrogen as a result of a point impact, but we see not dark, but luminous lines indicating the refraction or scattering of part of the energy, as was observed in the experiment [J. Schors *et al*.]

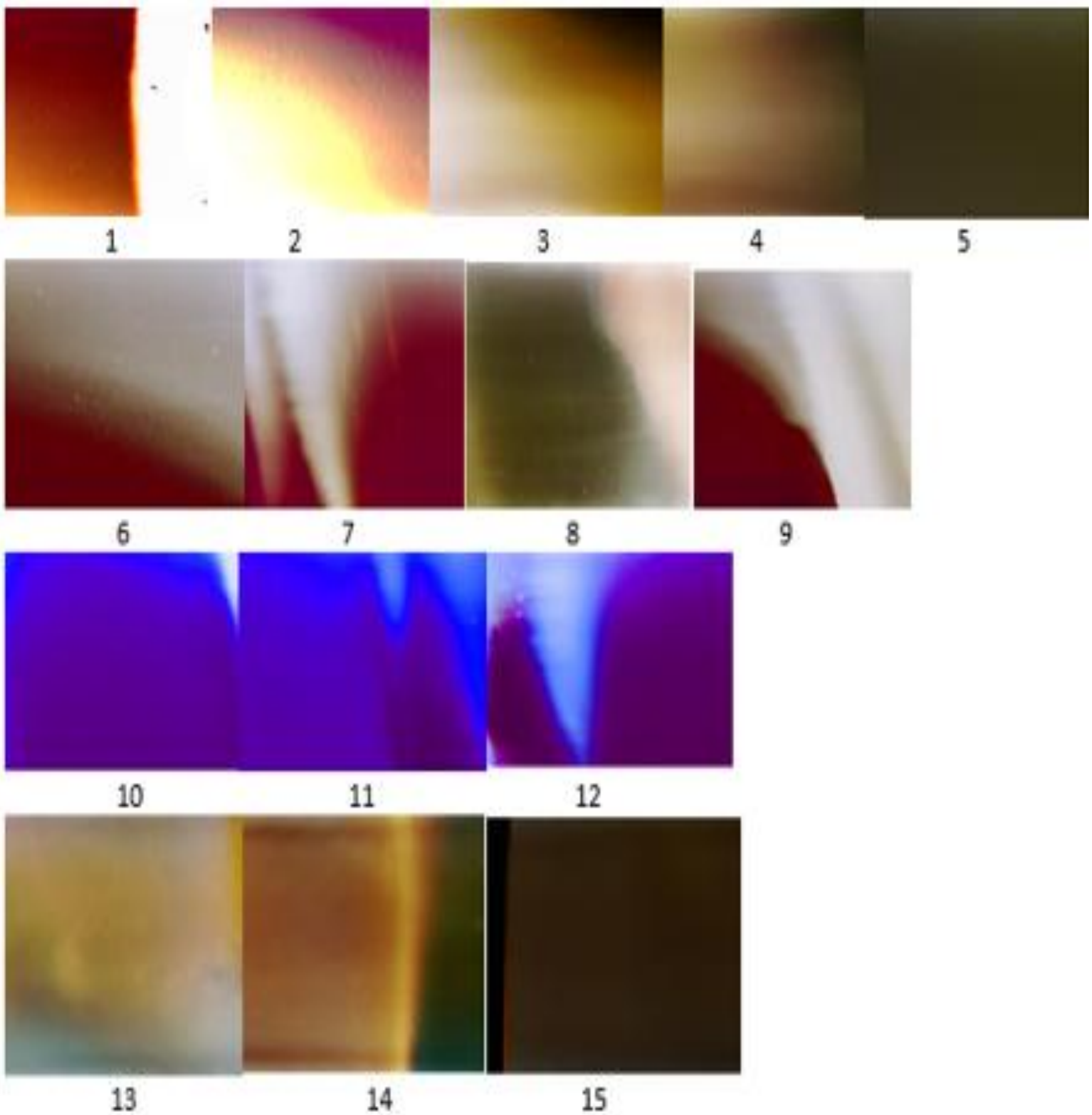

Fig. 4

15 photographs taken during welding are intended to demonstrate the possibilities of quality control of a new weld during its formation.

The color of an area is determined by the concentration of the chemical element or their ratio. X-rays are due to the transition of electrons not to the valence levels, but to deeper levels. This leads to the fact that the influence of neighboring atoms is reduced. Special studies are needed to find the relationship between the radiation wavelength (color) characterizing the concentration of a chemical element in a given weld area and its quality. Such studies have not been performed. Welding alloys were random, no welding conditions were monitored.

The analysis of photographs should be regarded as conditional, intended to show the fundamental difference between the method of monitoring atomic reactions and methods based on classical mechanics.

1. Energy radiation characterizes those areas where energy does not accumulate. Such areas are the most durable. The dark region indicates that the energy emitted by other atoms is absorbed. Energy absorption is accompanied by the transition of atoms to higher energy levels or additional ionization. If this electron is captured by another atom, a compound is formed, most often a compound of a metal with a non-metal, for example, oxygen (corrosion). The formation of such an area leads to disruption of the structure, reducing strength. The formation of a compound is accompanied by the release of energy, which may prove sufficient to form a new defect. For example, during the formation of one molecule of aluminum dioxide, energy is released enough to melt 4-5 neighboring cells.
2. The white area between frames 1 and 2 indicates the simultaneous emission of atoms of different (at least three) elements, while frames 3, 6, 8, 9, 14 indicate the formation of dangerous areas.
3. Of particular danger are the areas shown in frame 5 and between frames 14-15!
4. *But all theoretical conclusions need experimental verification.*

The U. S. Patent Application NON-IVASIVE MONITORING OF ATOMIC REACTIONS TO DETECT STRUCTURAL FAILURE No. 62/674,107 is based on numerous experimental studies shown in the table.

The 100% reliability and simplicity of the experiment show that this fact is due to a natural phenomenon called self-emission transparency. Analysis of the experimental results allowed to formulate the law of destruction.

The term "fatigue" has been used for 180 years, but a method for the quantitative determination of material fatigue has not yet been proposed. This made it possible to propose equations for calculating the accumulated energy during the operation of a structure or device that characterizes the degree of wear and aging, and to terminate operation until a critical state is reached.

Thus, the evaluation of energy accumulated during operation is the only method by which catastrophic destruction can be prevented. Experimental methods for measuring the intensity of electromagnetic radiation in the whole range have been developed and there are no fundamental difficulties for using them.

Monitoring atomic reactions in accuracy, sensitivity and efficiency is superior to all existing methods.