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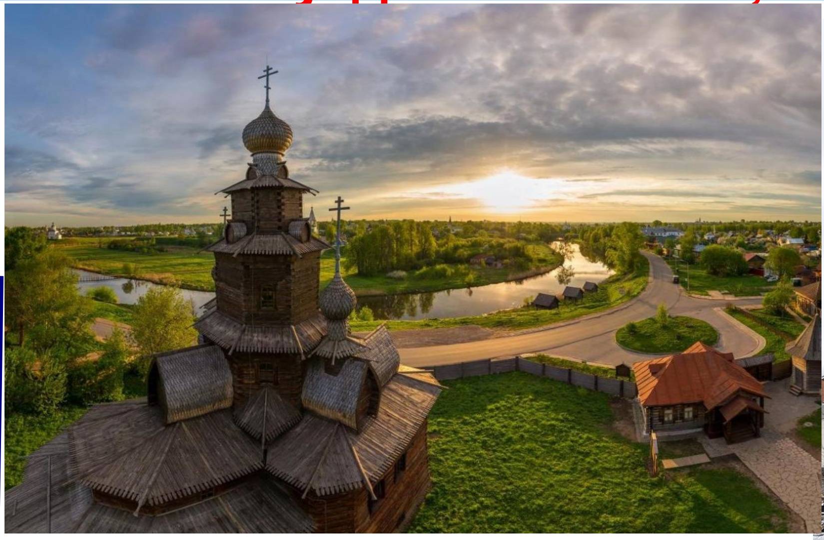


A.V. Ostrik, D.N. Nikolaev

GAS DYNAMIC DEVICES FOR STRENGTH TESTING OF CONSTUCTIONS TO ACTION OF DIRECTED ENERGY FLUXES

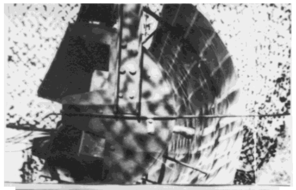
Institute of Problems of Chemical Physics RAS, Chernogolovka 142432, Russia

REQUIREMENTS TO THE DEVICES MODELING MECHANICAL ACTION OF RADIATION FLUXES

The radiation type	Radiation parameters				External conditions	Characteristics of loading	
	λ, Å	τ, s	*q*, MW/cm²	W, kJ/cm²		τ_p, *s*	I_p, kPa×s
Visible and infrared radiations	$4\times10^{3}...10^{5}$	$10^{-5}...2\times10^{-4}$	10...500	1...10	in air	$5\times10^{-5}...3\times10^{-4}$	0,1...2
The ultra-violet radiation	$3\times10^{3}...10^{4}$	$10^{-7}...10^{-5}$	$10^{2}...10^{4}$	1...10	in vacuum	$10^{-7}...10^{-5}$	0,1...3
The ultra-soft X-ray radiation	10...300	$10^{-10}...10^{-8}$	$10^{2}...10^{7}$	1...10	in vacuum	$10^{-8}...10^{-6}$	0,1...5
	100...300	$10^{-11}...10^{-8}$	$10^{2}...10^{7}$	0,1...1	after passing air environment	$10^{-8}...10^{-6}$	0,05...0,5
The soft X-ray radiation	0,6...10	$10^{-8}...10^{-7}$	$10^{3}...5\times10^{5}$	0,1...5	in vacuum	$5\times10^{-7}...5\times10^{-6}$	0,07...3
The hard X-ray radiation	0,15...10	$5\times10^{-9}...5\times10^{-8}$	$2\times10^{3}...10^{6}$	0,1...5	in vacuum	$10^{-8}...5\times10^{-8}$	0,05...4
					in vacuum and the barrier containing heavy chemical elements	$5\times10^{-7}...5\times10^{-6}$	0,1...5
	0,15...10	$10^{-6}...10^{-5}$	$10...10^{3}$	0,3...1	after passing air environment	$10^{-6}...10^{-5}$	0,02...1

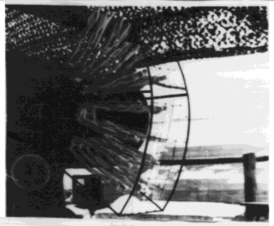
EXPLOSIVE DEVICES FOR NON-STATIONARY LOADING

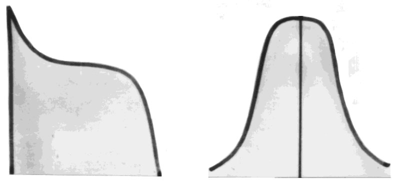
The charge equidistantly placed above the surface



$P_{max}=10^2 \div 10^5$ кг/см^2
$\tau = 10^{-6} \div 10^{-4}$ с

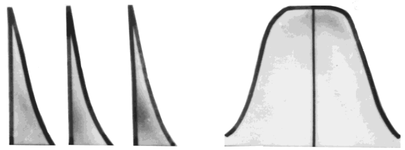
The charge placed with the specified volume distribution above the surface





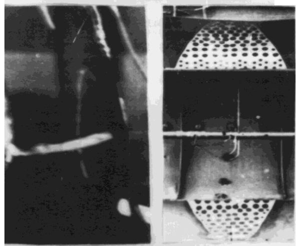
$P_{max}=10 \div 10^2$ кг/см^2
$\tau = 10^{-4} \div 10^{-3}$ с

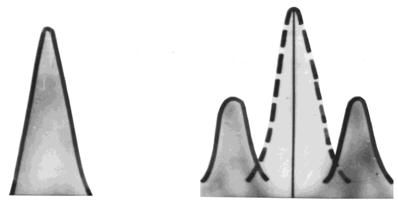
The shock tube of explosive action



$N=1 \div 3$
$P_{max}=10 \div 10^2$ кг/см^2
$\tau = 10^{-5} \div 10^{-4}$ с, $\tau_{сл}<10^{-3}$с

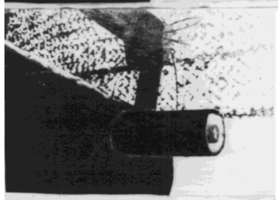
The charge located in contact with the surface by separate sectors

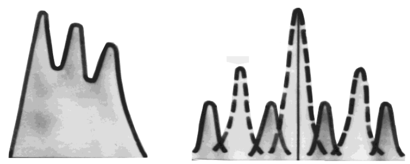




$P_{max1}=10 \div 10^3$ кг/см^2
$P_{max1}/ P_{max2}=2 \div 10$
$\tau=10^{-5} \div 10^{-4}$ с

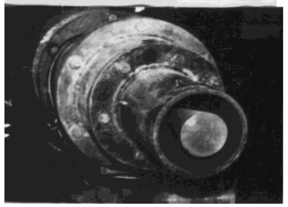
The volume-distributed commulative charge

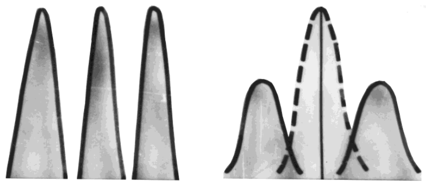




$P_{max1}=10 \div 10^2$ кг/см^2
$P_{max1}/ P_{max2}=2 \div 10$
$\tau=10^{-4} \div 10^{-3}$ с

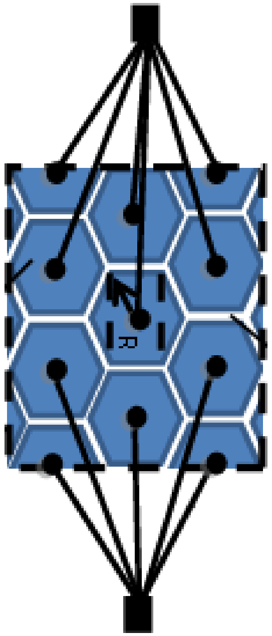
The shock tube of explosive action with body of revolution





$N=1 \div 3$, $P_{max1}=10 \div 10^2$кг/см^2
$P_{max1}/ P_{max2}=2 \div 10$
$\tau=10^{-5} \div 10^{-4}$ с, $\tau_{сл}<10^{-3}$с

NEW EXPLOSIVE DEVICES FOR IMPULSE LOADING



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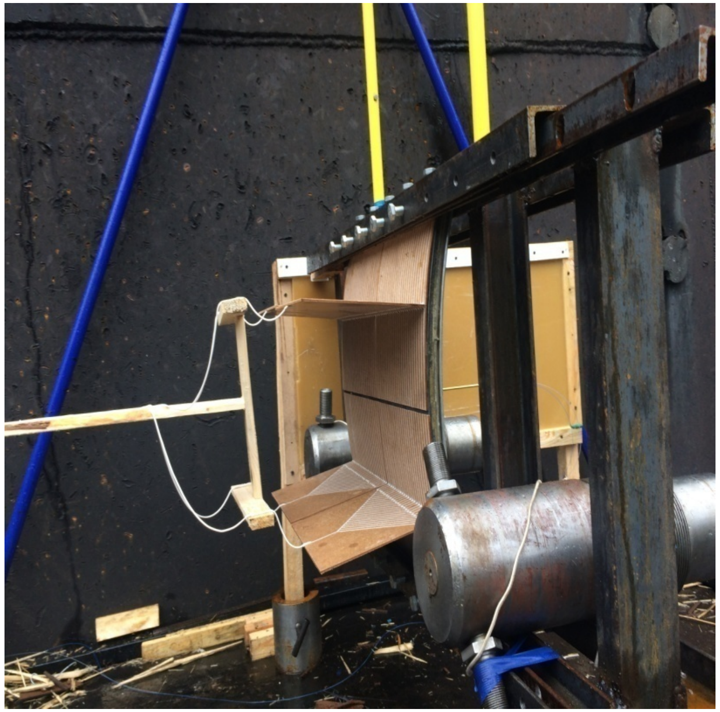
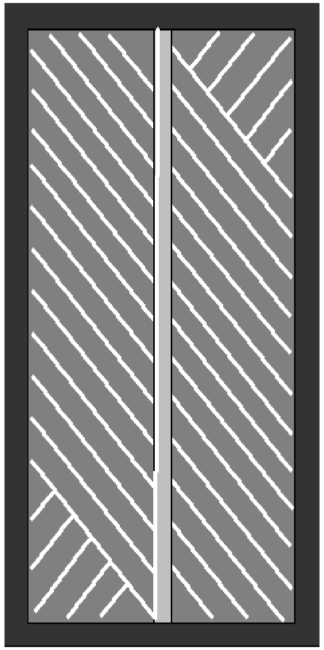
RIBBON CHARGE



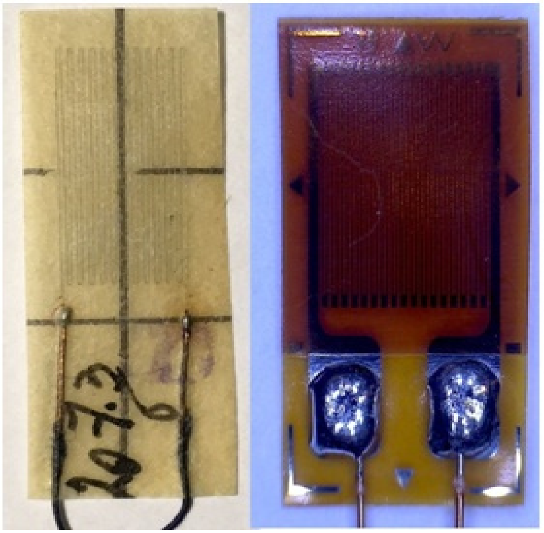


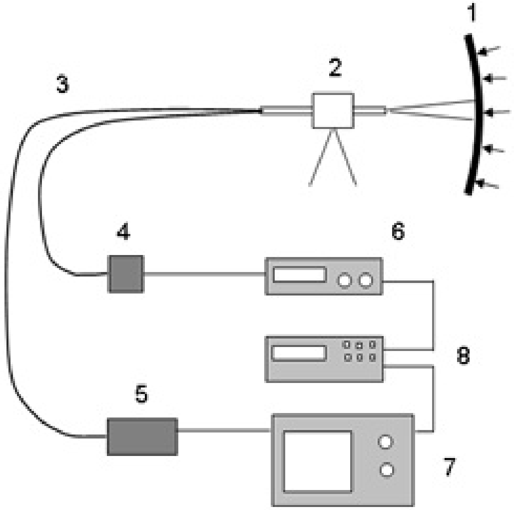
CONTACT CHARGE WITH THE CONTROLLED INITIATION

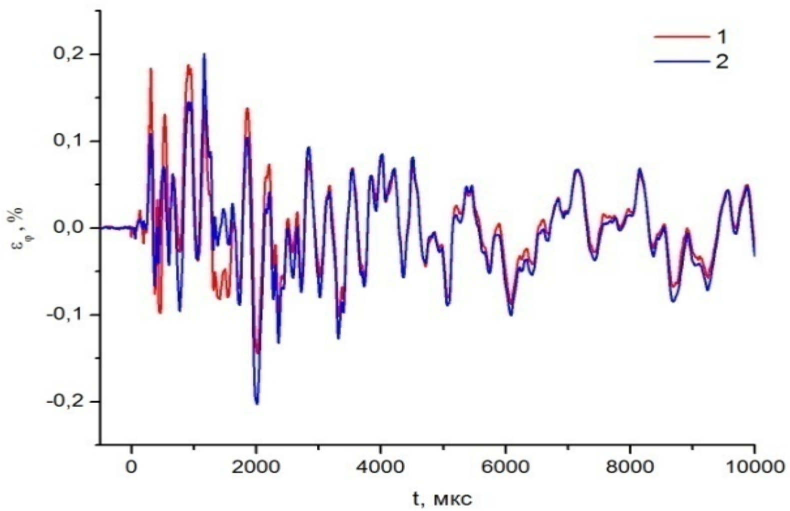
ε_{φ}

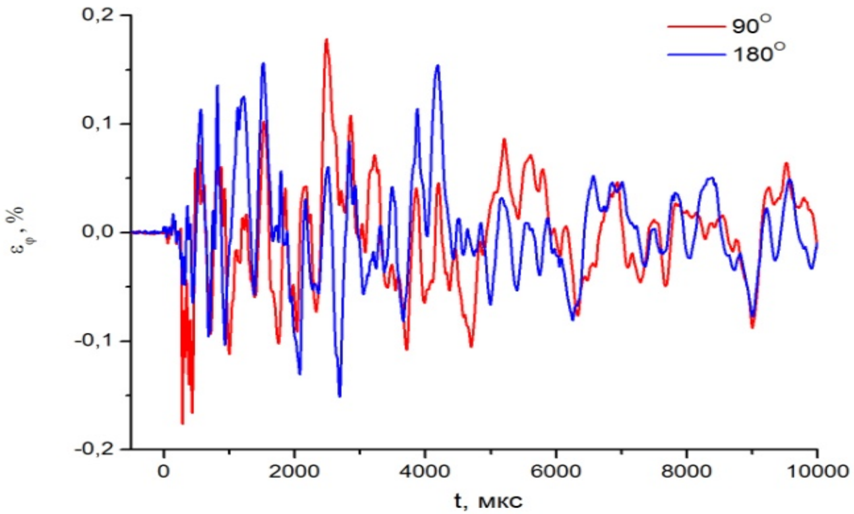
VERIFICATION OF NEW DEVICE

4









Circular deformations ε vs time t: a) comparison of circular deformations at $\varphi = 0$ measured by various sensors (1 is by the KB-10-200 strain sensor, 2 is by the BF350-3AA strain sensor); b) 1 is $\varphi = 90$, 2 is $\varphi = 180$

CONCLUSIONS

- A computing-experimental method of confirming the performance of a multilayer porous package for protection of the thin-walled composite constructions of rocket and space engineering (RSE) is proposed.

- Explosive technologies can be successfully applied to modeling of the mechanical action of energy fluxes of different physical nature at the RSE. At present there is a tested set of explosive gas-dynamic devices and a set of techniques to measure the parameters of response for carrying out experimental investigations of strength of thin-walled composite constructions of RSE in a wide range of spatial-time characteristics of lateral non-stationary load.

- The proposed two new explosive devices for generation of low-impulse loads significantly expanded the capabilities of this set for testing of thin-walled constructions.

- It is obtained that when investigating the shell stage of deformation of fiberglass thin-walled constructions, the use of wire and foil strain sensors to measure the deformations provides the close results.