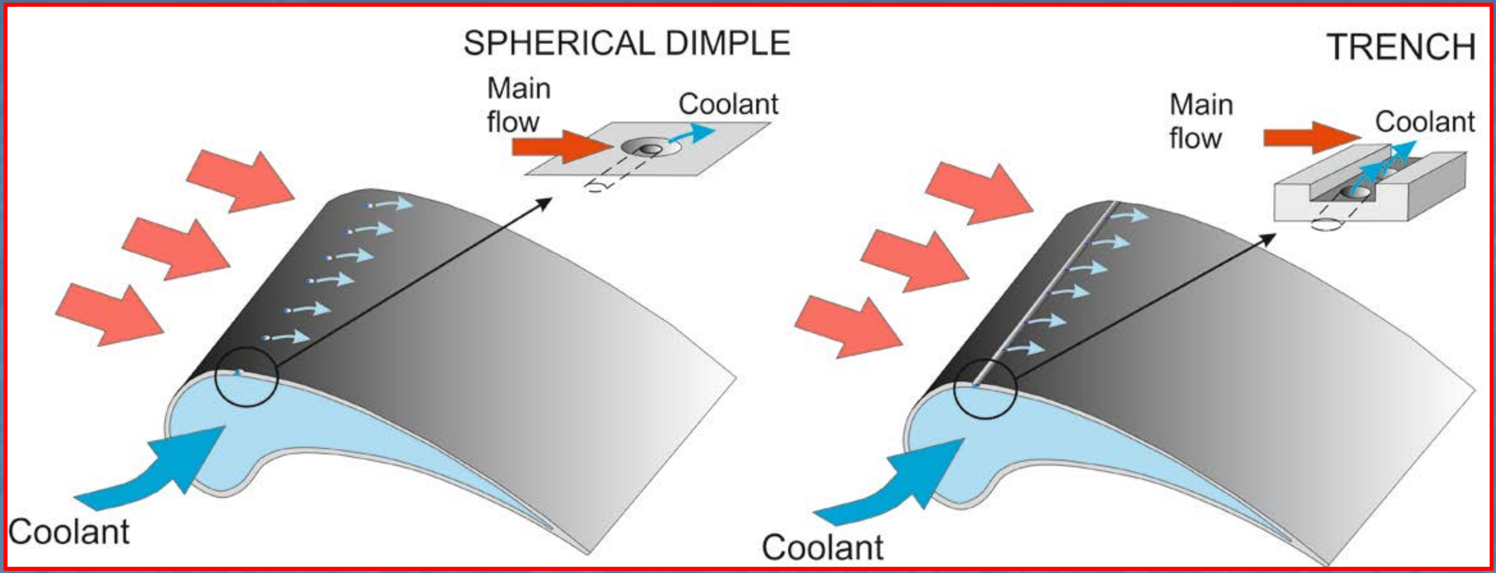
FUNDAMENTAL RESEARCH

PERSPECTIVE SCHEMES OF FILM COOLING OF BLADES OF HIGH PERFORMANCE GAS TURBINES



Idea: Coolant supply to the group of dimples of different configuration made on the gas turbine blade surface to decrease flow separation and minimize negative influence of vortex structures

Practical favour: Increase in the film cooling efficiency 1.5…2.5 times as large in comparison with traditional schemes of holes without dimples, decrease in the coolant mass flow rate for 10…15%. Results of this study have been used in the leading gas turbine plants of Ukraine – Gas Turbine Research & Production Complex «Zorya–Mashproect» (Mykolaiv) and Zaporizhzhya Machine-Building Design Company «Ivchenko–Progress», in developing perspective high performance gas turbine engines for Navy and Air Force (implementing acts 2012…2014).

Patents of Ukraine: №47749, 2004, application for patent of Ukraine №201504484, 2015

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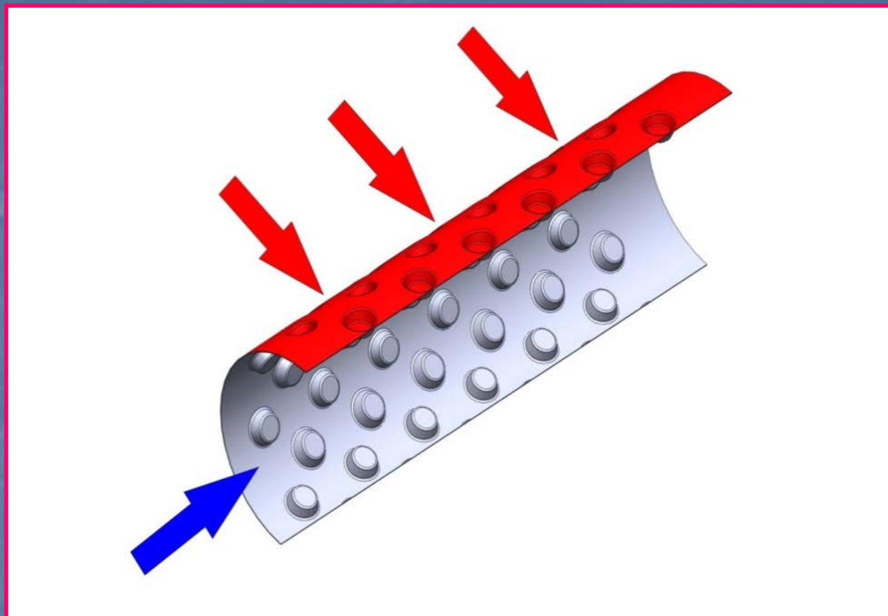
HEAT TRANSFER SURFACES FOR GAS TURBINE AND COMBINED CYCLE GAS TURBINE PLANTS



- **In cross flow of tubes bundle with surface dimples heat transfer enhancement is 1.3...1.7 as large along with the hydraulic losses decrease by 20% downstream offset of the separation zone.**
- **Heat transfer enhancement is 1.3 as large in the moderate increase hydraulic losses (1.7 as large)**
- **Application: regenerators of gas turbine engines in pipeline network of Ukraine, gas turbines for aero engines.**

Patent of the Ukraine №13888, 1997

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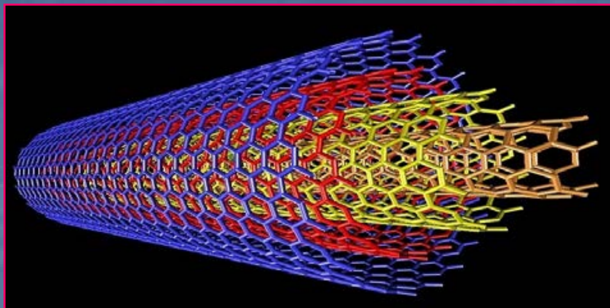
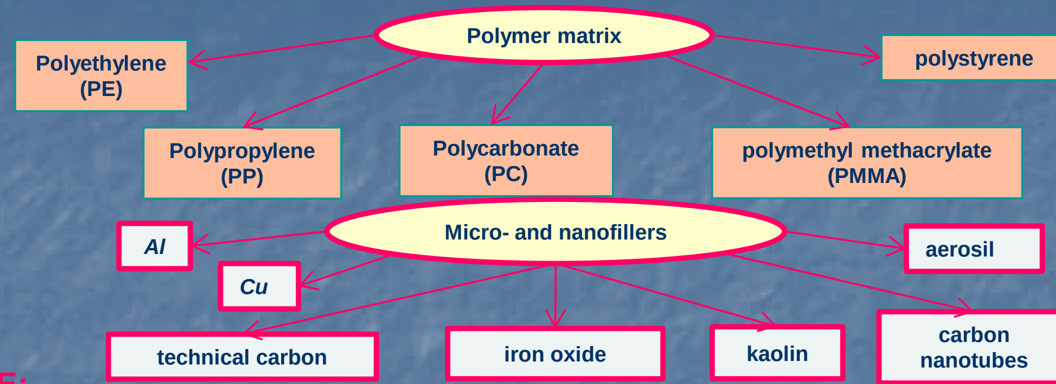
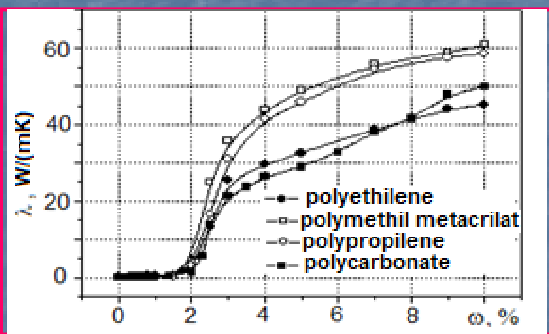
POLYMERIC MICRO AND NANOCOMPOSITES FOR ELEMENTS OF HEAT AND POWER EQUIPMENT







Dependence of thermal conductivity of composites on the mass fraction of carbon nanotubes

PURPOSE:

Improving the durability and reliability of heat exchange surfaces of elements of heat and power plants and pipelines of various energy systems.

ADVANTAGES

- high level of thermal insulation properties;
- improved mechanical performance;
- increased corrosion resistance.

EFFICIENCY

- reduction of heat losses in heat lines for various purposes
- increase in the life of the heat and power equipment

Characteristics of a type series of polymer micro- and nanocomposites for heat transfer surfaces

T_{max}, K	λ, W/mK	Poly-mer type	Filler type	Filler fraction, %	T_{max}, K	λ, W/mK	Poly-mer type	Filler type	Filler fraction, %	T_{max}, K	λ, W/mK	Poly-mer type	Filler type	Filler fraction, %
	20	ПЕ	Al	4,3		20	PP	Al	3,3		20	PC	CNT	2,9
	30	PMMA	CNT	2,8		30	PP	CNT	3,1		30	PC	CNT	5,2
390	40	PMMA	CNT	3,5	425	40	PP	CNT	3,9	470	40	PC	CNT	7,5
	50	PMMA	CNT	5,3		50	PP	CNT	6,0		50	PC	CNT	10,0
	60	PMMA	CNT	9,5		55	PP	CNT	7,5					

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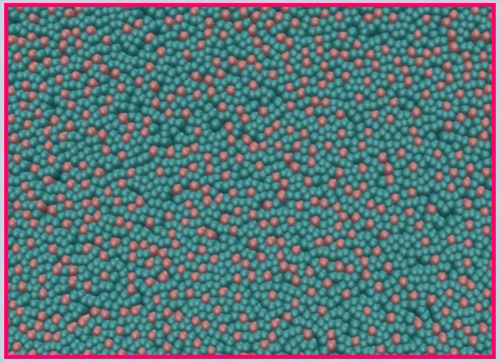
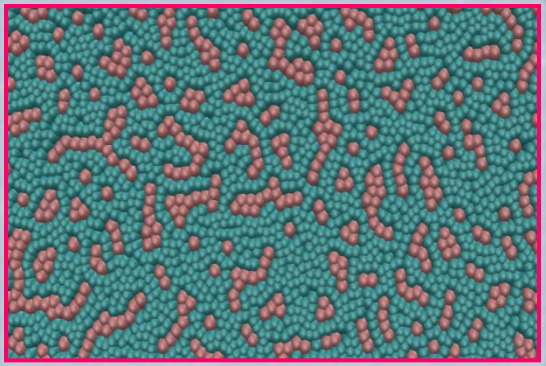
COMBINED MATHEMATICAL MODEL OF MOLECULAR DYNAMICS AND DISSIPATIVE PARTICLE DYNAMICS IS DEVELOPED WHICH ALLOWS TO CALCULATE THE COLLOIDAL NANOSTRUCTURES OF HYDROPHOBIC AND HYDROPHILIC NATURE

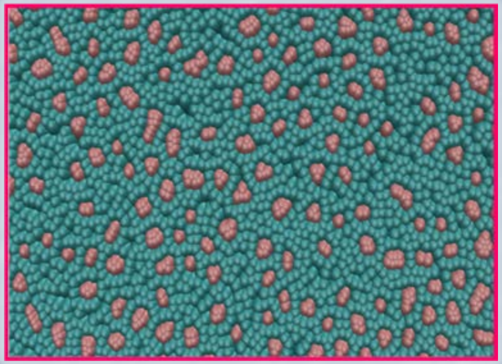
Spherical micelles



Rod-shaped micelles



Globular structure

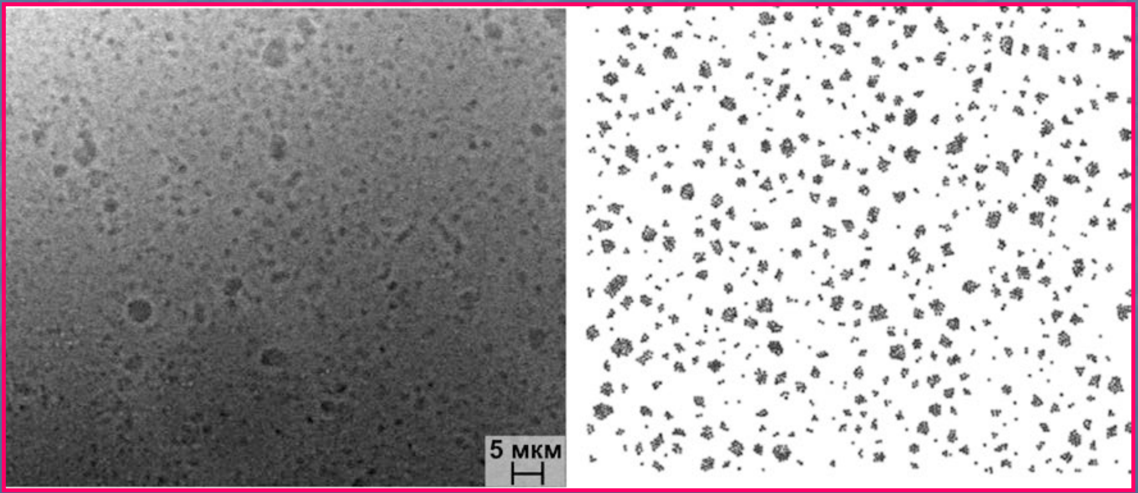


$$m_i \frac{d^2 r_i}{dt^2} = F_{ij}(r), \; i = 1, 2, \ldots, N,$$

$$F_{ij} = \begin{cases} \pi \; \omega_1 - \gamma_{ij} m_i \omega_2 (\mathbf{v}_{ij} \cdot \mathbf{e}_{ij}) + \dfrac{\delta_{ij}\theta_{ij}}{\sqrt{\Delta t}} \omega_1, \\ \dfrac{24\varepsilon_{ij}}{r_{ij}} \left[\left(\dfrac{\sigma_{ij}}{r_{ij}} \right)^6 - 2 \left(\dfrac{\sigma_{ij}}{r_{ij}} \right)^{12} \right], \end{cases}$$

Comparison of theory and experiment

Globular structures in the "Aerosil A-175®—Water" system: (a) photo of structure (640 times larger scale), (b) calculated configuration of particles



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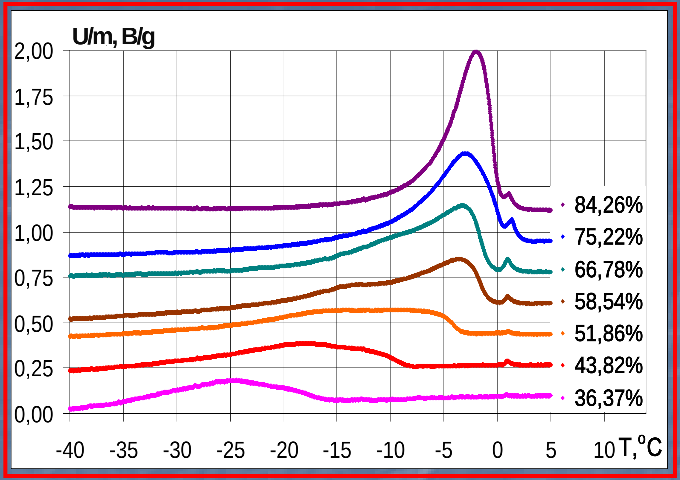
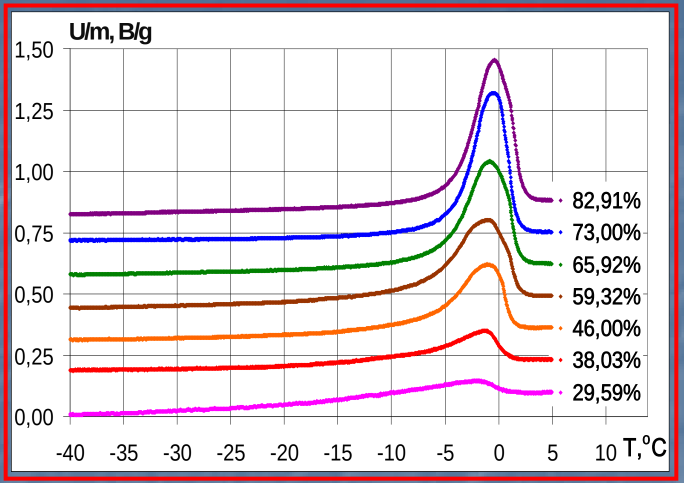
STUDY OF THE STATE OF WATER IN COLLOIDAL CAPILLARY-POROUS MATERIALS AND SOLUTIONS BY MEANS OF DSC

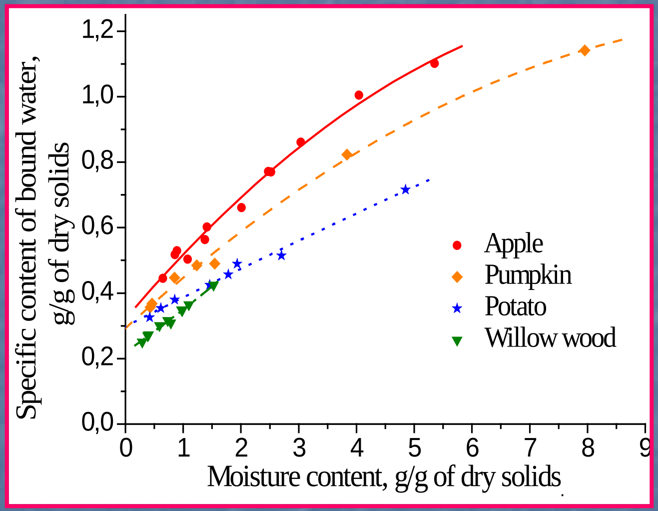
Apple



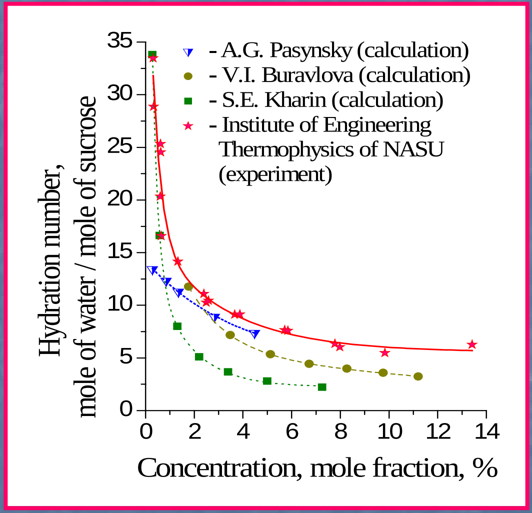
DSC curves

Potato

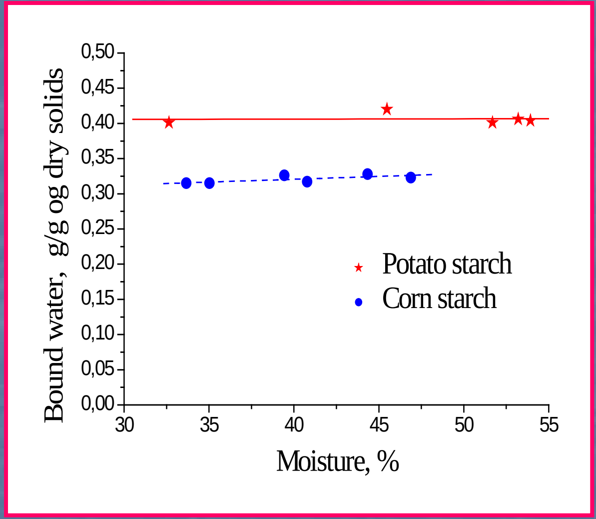




Changes of the specific content of bound water in plant material during drying process



Dependence of degree of hydration of the sucrose solution on its concentration



Dependence of bound water content on moisture content of starch

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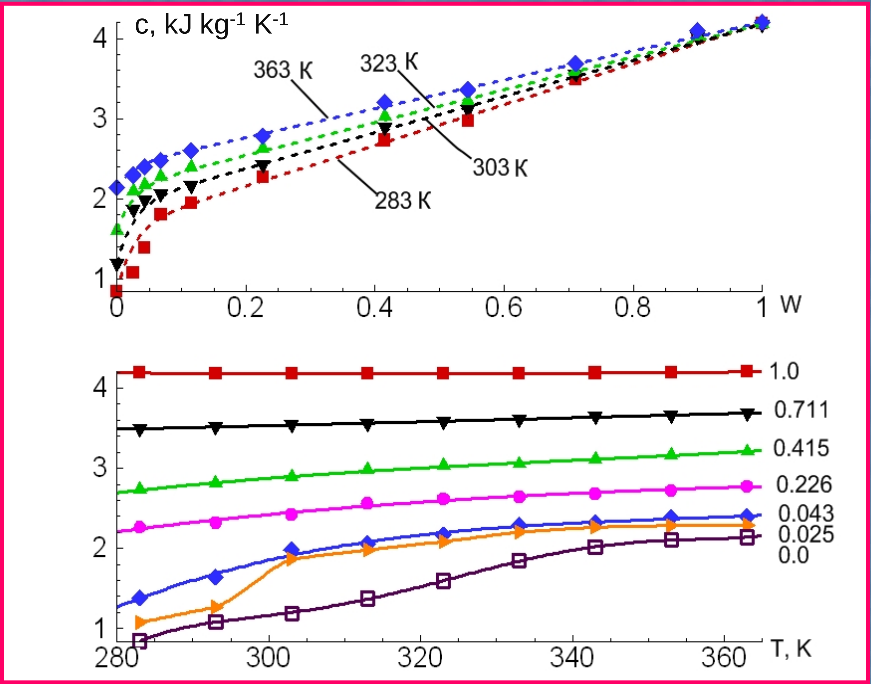
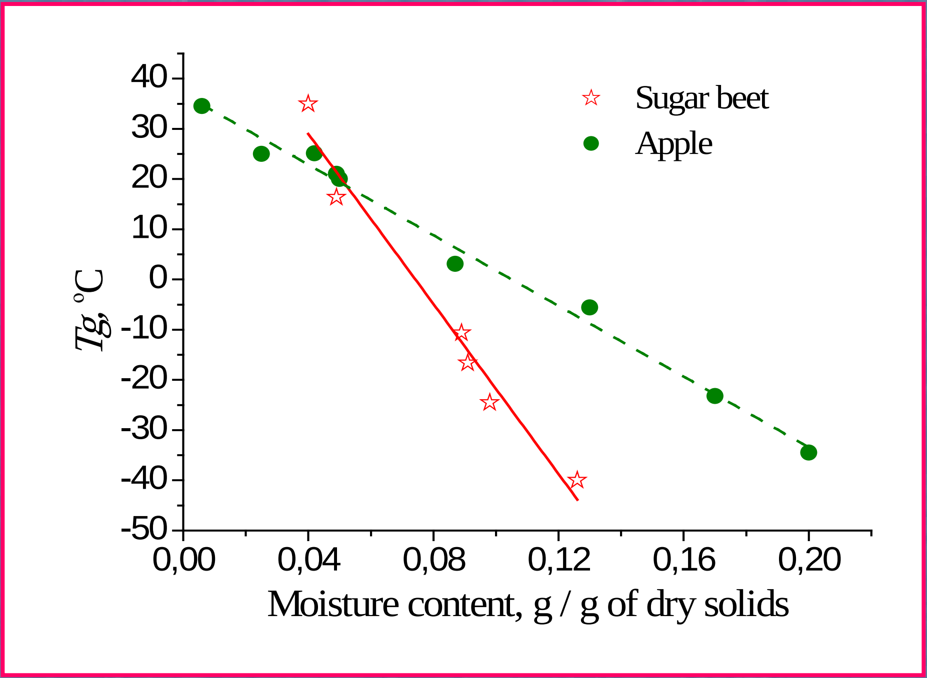
STUDY OF THERMAL AND PHYSICAL CHARACTERISTICS OF MATERIALS BY MEANS OF DSC

Specific heat capacity of apple



Dependence of glass transition temperature in tissues of sugar beet and apple at low humidity



Range: temperature t = 10 – 90 °C

moisture W = 6,8 – 90,0 %

$$c\,(t, W) = 1605{,}3 + 26{,}26W + 9{,}27t - 0{,}092Wt$$

(kJ kg^{-1} K^{-1})

$$T_g = 34{,}78 - 339{,}8W$$

$$T_g = 62{,}83 - 846{,}4W$$

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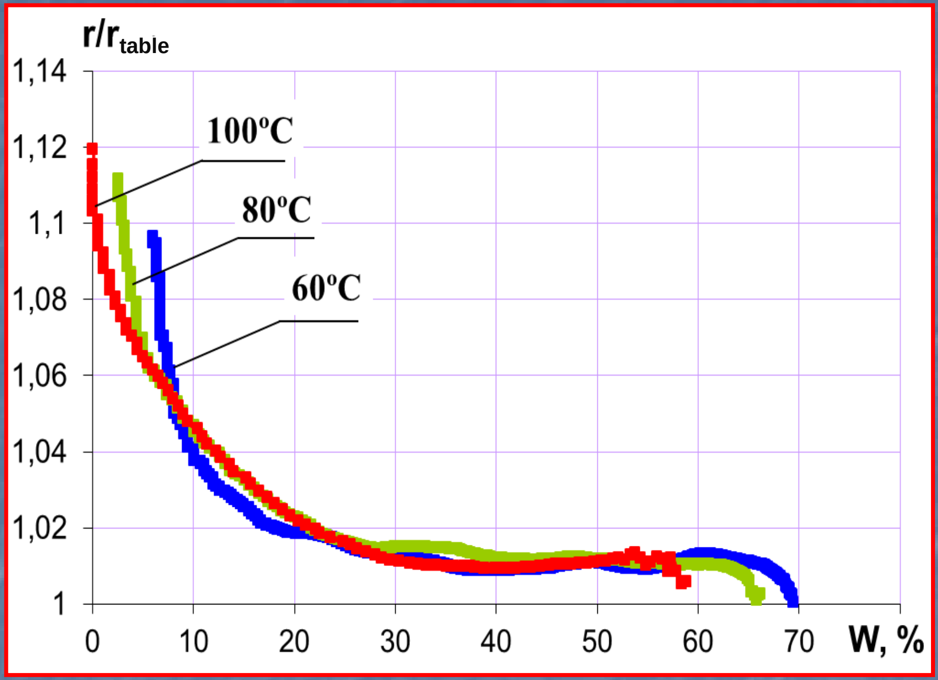
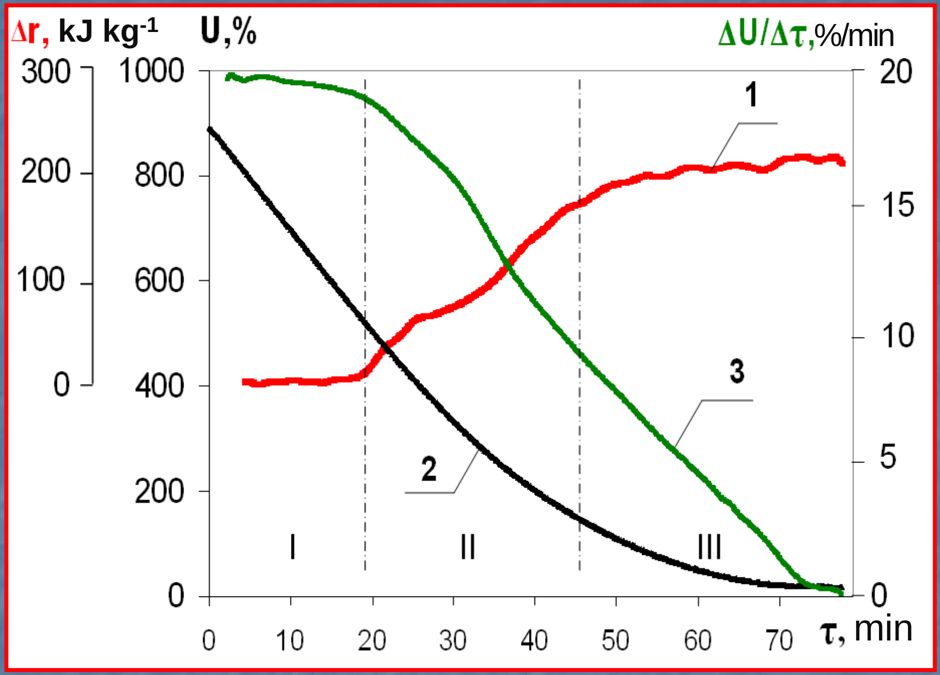
DETERMINATION OF HEAT OF EVAPORATION BY MEANS OF MICROCALORIMETER DMKV-01



The changes of the heat of evaporation of water from willow shoots at different temperatures of drying



Evaluation of convective drying curves of parenchyma tissue of apple with help of microcalorimeter
1 – thermogram; 2 – drying curve;
3 –drying rate curve

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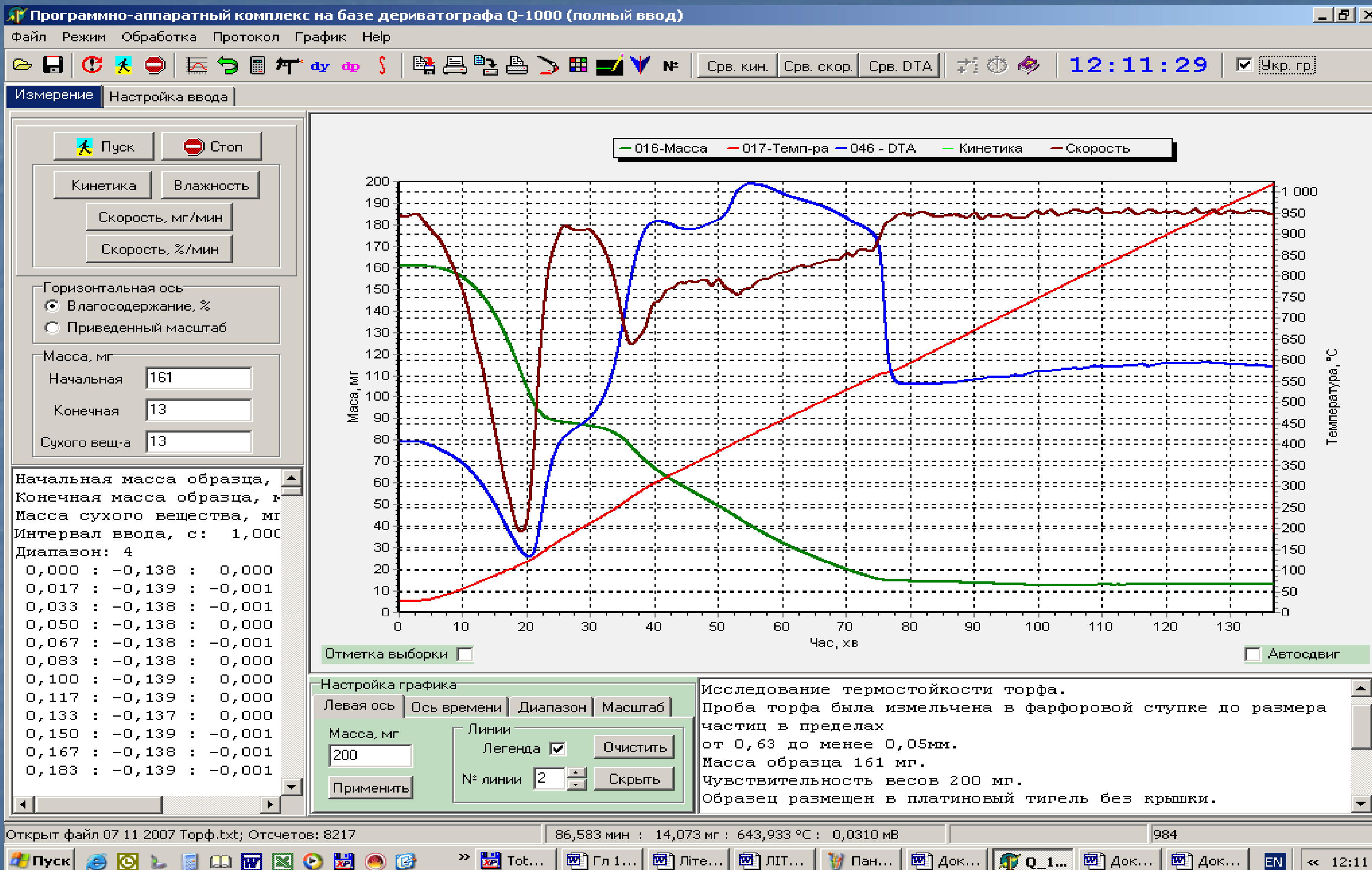
THE STUDY OF THERMAL DECOMPOSITION OF SOLID FUELS BY DERIVATOGRAPHIC METHOD



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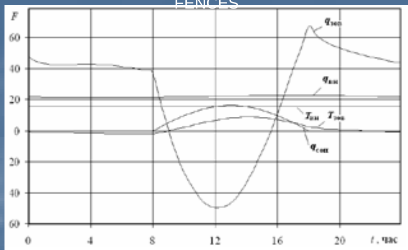
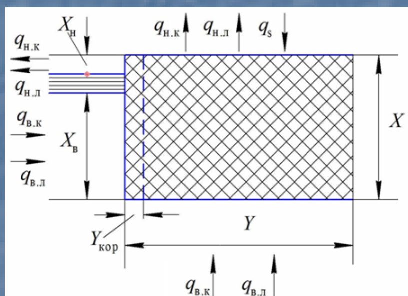
THERMOPHYSICAL BASES OF INCREASE OF BUILDINGS ENERGY EFFICIENCY

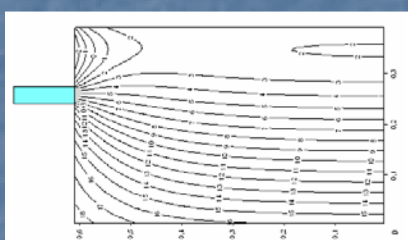
CHANGES IN TEMPERATURE AND DENSITY OF THE HEAT FLOW ON EXTERNAL AND INTERNAL SURFACES OF FENCES



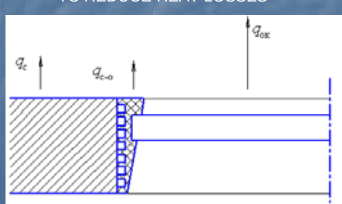
INFLUENCE OF THE WINDOW OPENING ON THE HEAT TRANSFER THROUGH THE FENCES



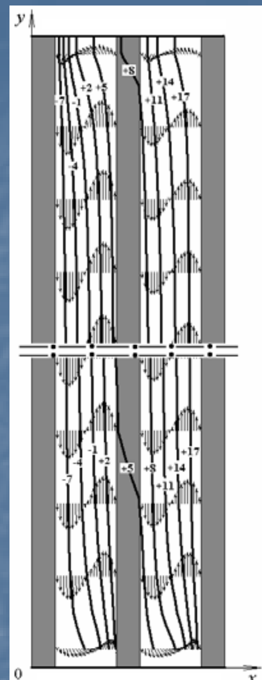
TEMPERATURE DISTRIBUTION ON THE THICKNESS OF WALLS FROM CLOSING WINDOWS IN WINTER

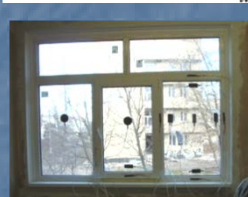


APPLICATION RIBBED WINDOW BOX TO REDUCE HEAT LOSSES

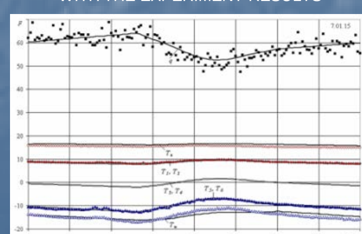


VELOCITY AND TEMPERATURE FIELDS IN THE DOUBLE-GLASS

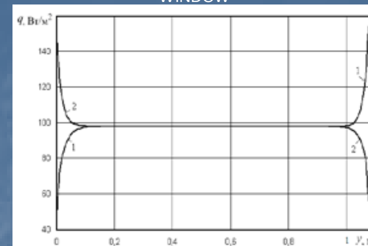




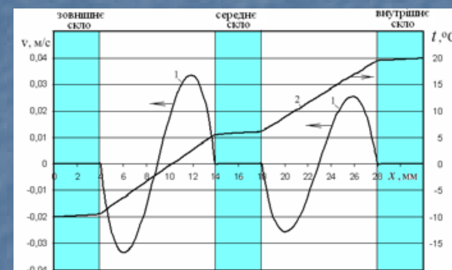
COMPARISON OF CALCULATION RESULTS WITH THE EXPERIMENT RESULTS



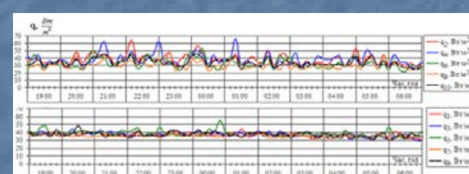
HEAT FLOW DENSITY DISTRIBUTION OVER THE SURFACE OF THE PACKET WINDOW



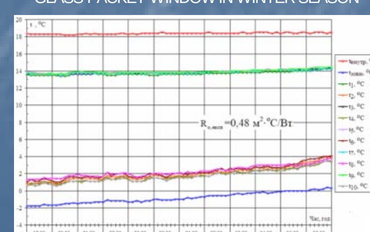
SPEED (1) AND TEMPERATURE (2) DISTRIBUTIONS ON THE THICKNESS OF THE DOUBLE-GLASS PACKET WINDOW



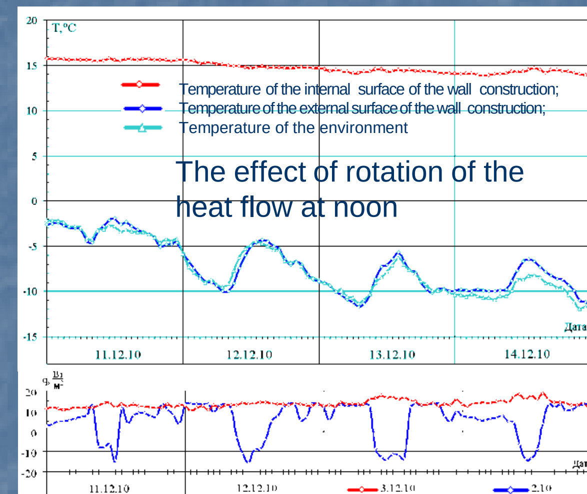
CHANGES OVER TIME OF HEAT FLOW DENSITIES OF EXTERNAL (TOP GRAPH) AND INTERNAL SURFACES OF THE DOUBLE-GLASS PACKET WINDOW IN WINTER SEASON

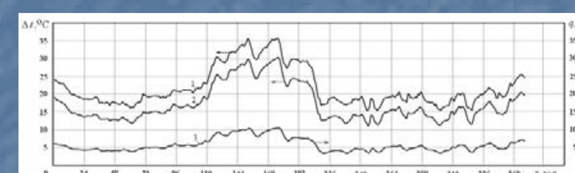


CHANGES OVER TIME OF HEAT FLOW DENSITIES OF EXTERNAL AND INTERNAL SURFACES OF THE DOUBLE-GLASS PACKET WINDOW IN WINTER SEASON

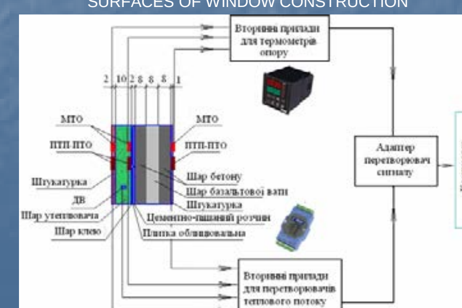


TIME CHANGES IN TEMPERATURE AND DENSITY HEAT FLOW ON EXTERNAL AND INTERNAL WALL SURFACES





INSTALLATION SCHEME FOR HEAT MEASUREMENT ON THE SURFACES OF WINDOW CONSTRUCTION



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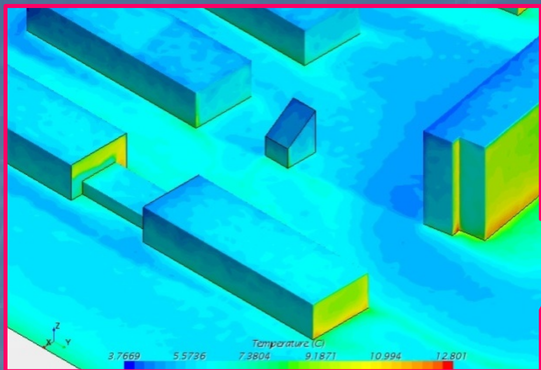
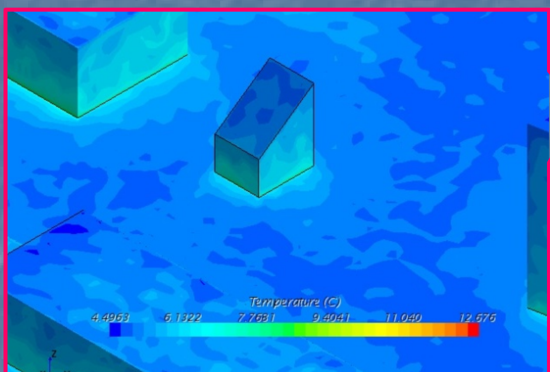
RADIATIVE-CONVECTIVE HEAT TRANSFER OF THE MUNICIPAL BUILDING IN VIEW OF SOLAR RADIATION

spring 2014

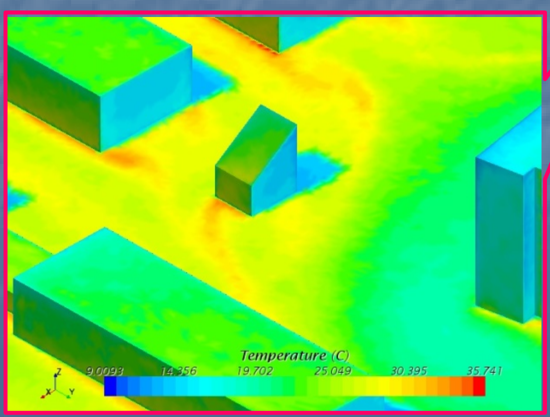
West wind- 3 м/s



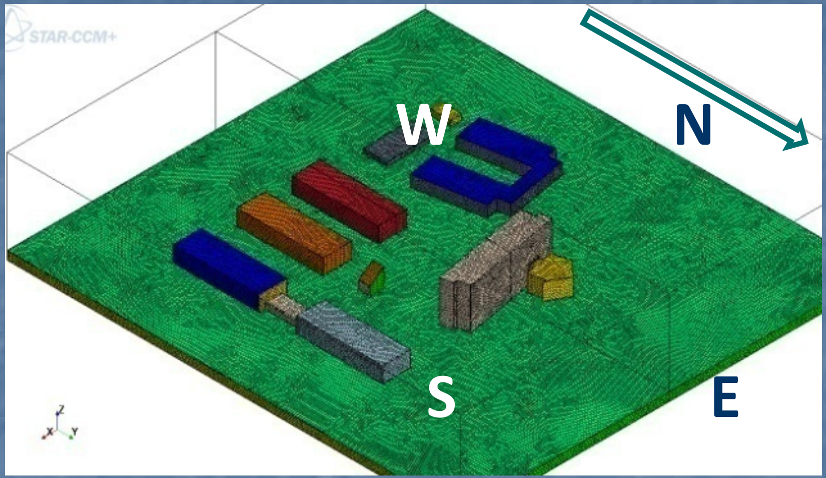
Field of temperatures, time 1:52 , night



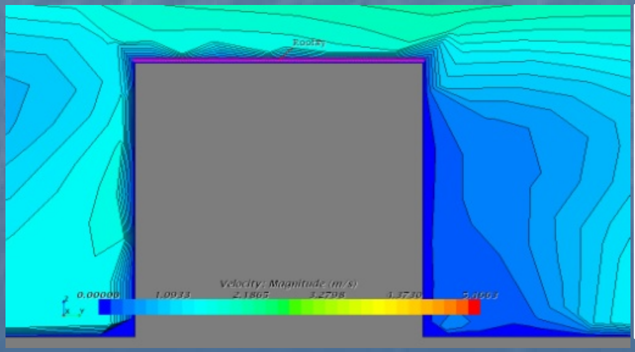
Field of temperatures, time 6:00, sunrise

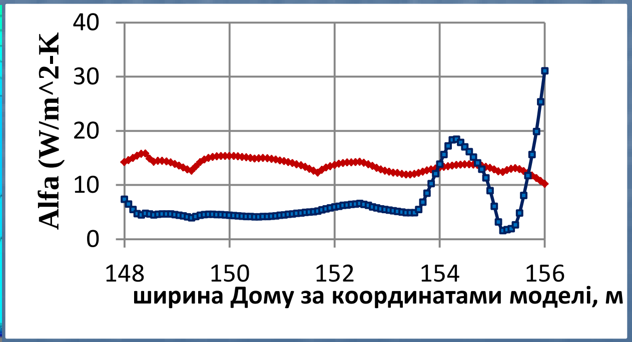


Field of temperatures, time 12: 14, day



FIELD OF VELOCITIES IN LONGITUDINAL SECTION AND VALUE OF THE COEFFICIENT OF HEAT TRANSFER ON THE ROOF OF THE PASSIVE TYPE BUILDING. WEST WIND 3 M/S. THE BLUE CURVE - 00 HOURS 00 MINUTES; RED - 12 HOURS 00 MIN





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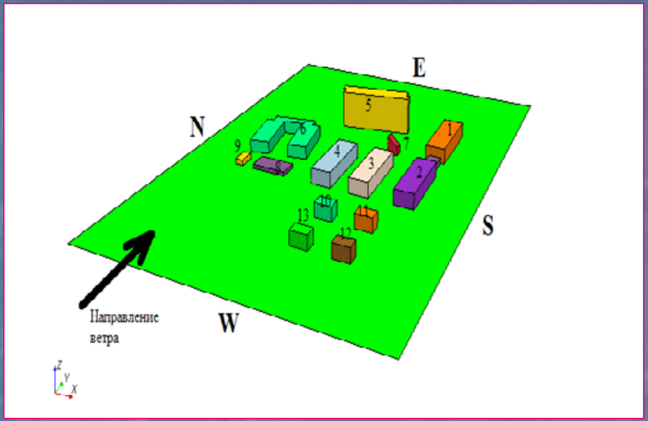
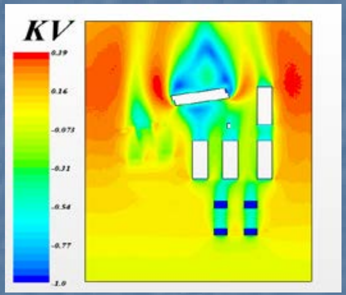
tel.: (044) 456-92-72, 424-25-27, e-mail: basok@ittf.kiev.ua

ESTIMATION OF ENERGY POTENTIAL OF WIND FLOW IN THE ZONE OF URBAN DEVELOPMENT

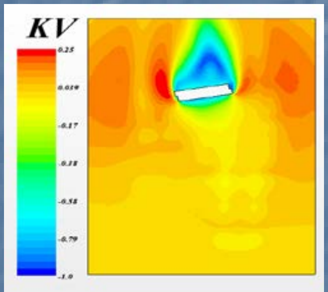
THE TARGET REGION - 13 SITES BUILDINGS OF IET NAS OF UKRAINE ON THE BULAKHOVSKOGO STR. 2



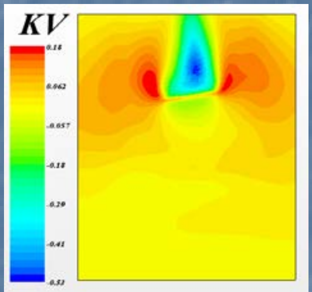
Fields of wind velocities U m/s at different heights
West wind 5 m/s at the height of Weathervane



H = 10 м



H = 20 м

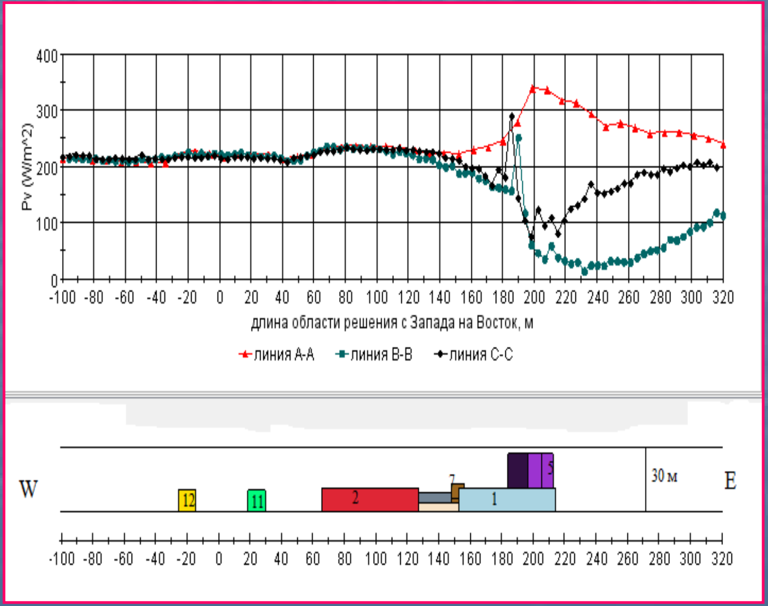


H = 30 м

$$P = C_p A \frac{\rho U^3}{2}$$

- the specific power of the wind flow

The specific power of the wind flow



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