UDK 628.1
https://doi.org/10.59911/conf.mpmgg.2025.s8

STRAIN-DEFORMATIONS IN SANDSTONE SiO_2, NANOCOMPOSITES

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The development of the process of accumulating mechanical damage due to irreversible bulk deformation, which depends on the stress state, can be positive (dilatancy) or negative (compaction), leading to the destruction of rocks. Strain-deformations in sandstone SiO_2, functionalized nanocomposites of polyamide, polyethylene, polyvinylchloride and multiwalled carbon nanotubes (MWCNTs) is represented. The correlation between the crystalline and amorphous components of polymer macromolecules interacting with rigid MWCNTs influences on elastic and anelastic characteristics of the nanocomposites.
Keywords: sandstone, rocks, strain, deformations, nanocomposites.

НАПРУГИ-ДЕФОРМАЦІЇ У ПІСКОВИКУ SiO_2, НАНОКОМПОЗИТАХ

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Розвиток процесу накопичення механічних пошкоджень внаслідок незворотної об'ємної деформації, який залежить від напруженого стану, може бути позитивним (дилатансія) або негативним (ущільнення), що призводить до руйнування гірських порід. Представлено напруги-деформації у пісковику SiO_2, функціоналізованих нанокомпозитах з поліаміду, поліетилену, полівінілхлориду та багатостінних вуглецевих нанотрубок (БШВНТ). Співвідношення між кристалічними та аморфними компонентами полімерних макромолекул, що взаємодіють із жорсткими БШВНТ, впливає на пружні та непружні характеристики нанокомпозитів.
Ключові слова: пісковик, гірські породи, напруга, деформації, нанокомпозити.

Experimental methods

Samples sandstone SiO_2, nanocomposites were cut [1,2,6]. Finishing was performed with diamond paste with a grain size d_G = 14/20 μm. The four-component piezoelectric vibrator at a frequency of $f \approx 118$ kHz, and the electrostatic method of bending resonance oscillations at a frequency of $f \approx 1$ kHz with deformation $\varepsilon \approx 10^{-6}$

in vacuum P ≈ 10^{-3} Pa were used [3-5]. The measuring error relative change of elastic modulus $\frac{\Delta E}{E_0} \approx 0.1\%$ and internal friction (IF) $\frac{\Delta Q^{-1}}{Q^{-1}} \approx 10\%$.

Results and discussion

The distribution diagrams of polarization vectors $\vec{P}$ of quasilongitudinal $V_{\parallel}$, "fast" quasitransversal $V_{\perp 1}$ velocity, of "slow" quasitransversal $V_{\perp 2}$ velocity in SiO_2 shows in Fig. 1, Fig. 2, in Fig. 3 respectively.

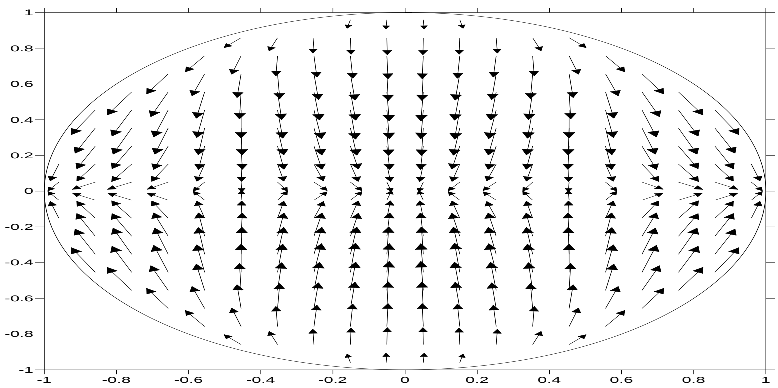

Fig. 1. The distribution diagrams of polarization vectors $\vec{P}$ of quasilongitudinal $V_{\parallel}$ velocity in SiO_2.

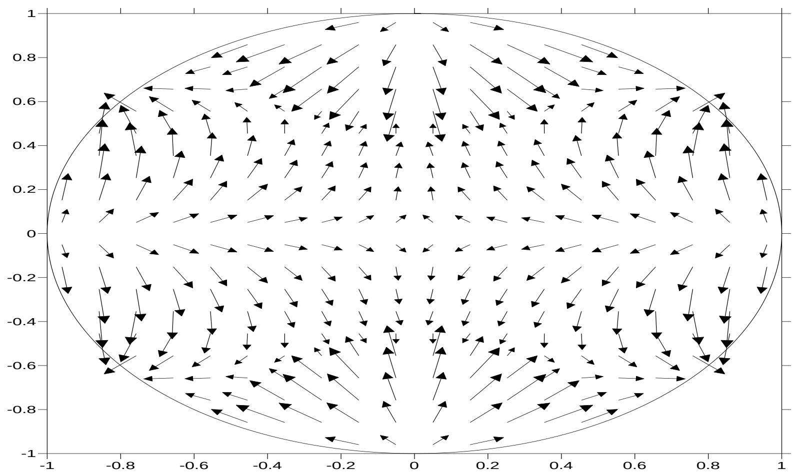

Fig. 2. The distribution diagrams of polarization vectors $\vec{P}$ of "fast" quasitransversal $V_{\perp 1}$ velocity in SiO_2.

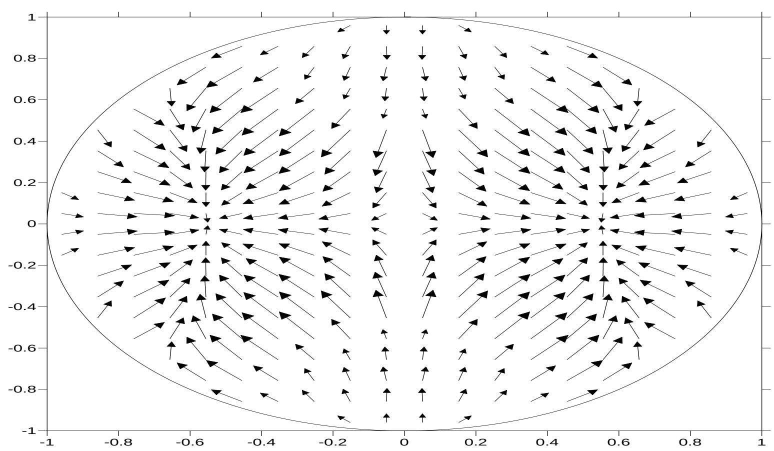

Fig. 3. The distribution diagrams of polarization vectors $\vec{P}$ of "slow" quasitransversal $V\perp_2$ velocity in SiO_2.

The stereoprojection of polarization angle - deviation of the vector of elastic displacements $\vec{U}$ from the direction of wave normal $\vec{n}$ $\varphi_p = (\vec{U},\vec{n})$ SiO_2 (isolines - in degrees) is represented in Fig. 4.

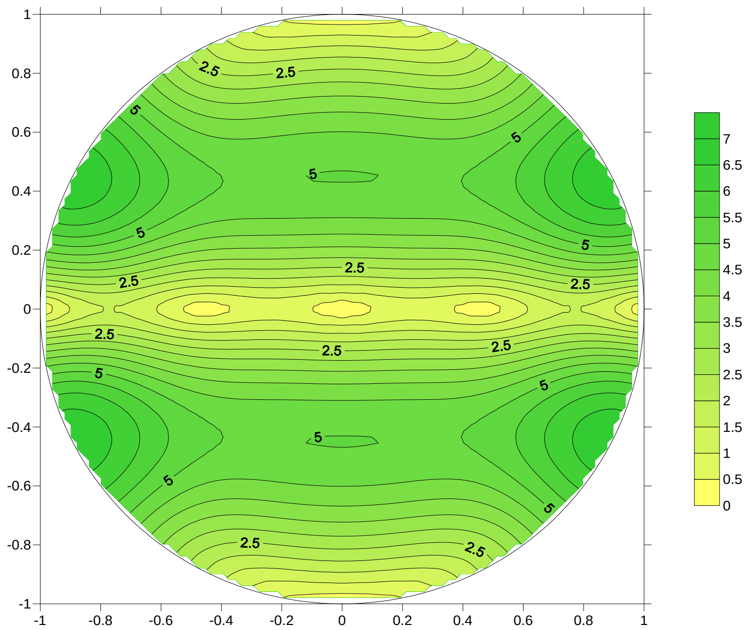

Fig. 4. The stereoprojection of polarization angle - deviation of the vector of elastic displacements $\vec{U}$ from the direction of wave normal $\vec{n}$ $\varphi_p = (\vec{U},\vec{n})$ SiO_2 (isolines - in degrees).

The stereoprojection of differential coefficient of elastic anisotropy A_d of SiO_2 (isolines - in %) is presented in Fig. 5.

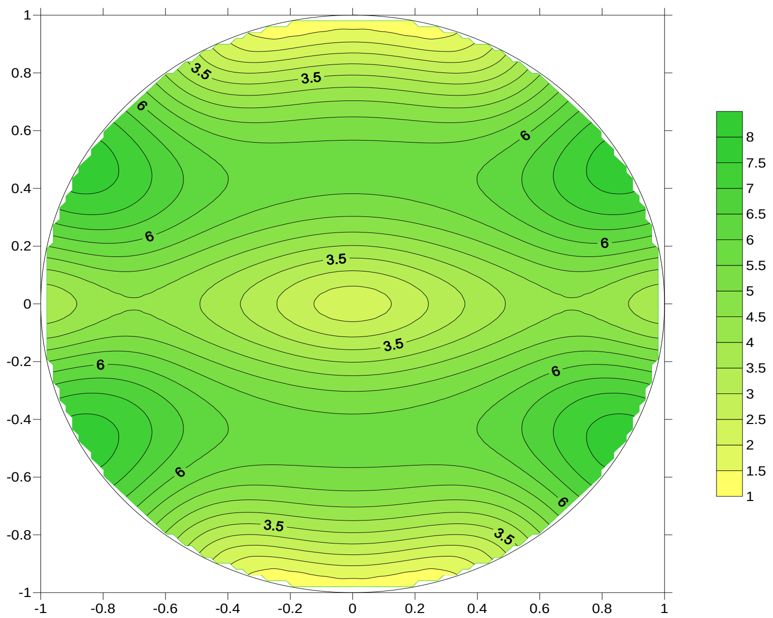

Fig. 5. The stereoprojection of differential coefficient of elastic anisotropy A_d of SiO_2 (isolines - in %).

Conclusions

1. The analysis of elastic anisotropy parameters A_d, A_μ of sandstone SiO_2 showed that the rhombic approximation provided the maximum harmonization of the calculated and the experimental data and the efficiency of using the invariant-polarization method to solve the acoustic texture analysis problems.

2. The polarization angle – the deflection of elastic displacements vector $\vec{U}$ from wave normal direction $\vec{n}$ $\varphi_{\vec{p}} = (\vec{U}, \vec{n})$ and differential coefficient of elastic anisotropy A_d, elastic anisotropy integral coefficient $\overrightarrow{A_\mu}$ are the most universal characteristics of anisotropy and testify about anisotropic deformation ε in sandstone SiO_2.

3. For the capture of external geological data thermogeoprobe contains devices for the selection of geological rocks and their express-analysis. Thermogeoprobe can be used for getting of deep minerals, underground penetration, deep geophysical secret service, gasket the tunnel, which can penetrate on no-bottoms in Earth rocks, by mealting of rocks by means of heat, which is generated.

4. The work of such analyzers must be built on use of chemical reagents, on characteristic property of mountain rock, which mealting. In case of secret service of deep sensors must be adjusted on concrete descriptions of oil, gas CH_4, coal and also on concomitant them elements. Methods of transmitting information and control signals to the superdeep thermogeoprobe and vice versa are selected depending on the conditions of its operation - with or without preservation of the wellbore.

Acknowledgements

This work has been supported by Ministry of Education and Science of Ukraine: Grant of the Ministry of Education and Science of Ukraine for perspective development of a scientific direction "Mathematical sciences and natural sciences" at Taras Shevchenko National University of Kyiv.

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