CHEMICAL STRUCTURE OF COAL SUBSTANCE

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Abstract

On the basis of structural parameters determinations the models of liptinite, vitrinite and inertinite at coals with medium coalification were suggested. As aromatic-cyclanic clusters form coal polymers with molecular weight of about 1300 – 1600, several polymers are associated by non-covalent interactions to an aggregate with molecular weight of about 7700 – 9700 which contains both planar formations of 1.1 – 1.2 nm in length and cylinder like formations of about 1 nm in the inner diameter. The suggested chemical models correspond with the physical models obtained on the basis of transmission electron microscopy and X-ray diffraction analyses. A very low content in the molecular phase led to one-phase models of the structure of investigated Upper Silesian Coal Basin coals.

KEYWORDS: coal, structural parameters, maceral fractions, liptinite, vitrinite, inertinite

CAGES BASED ON THE CARBON-CARBON COMPOSITES

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Abstract

The project aimed at developing a cage (for use in spine treatment) made of a carbon-carbon composite in two modes: 1) a cage composed of a bearing core made of titanium alloy with the surface contacting the bone made of the C/C composites in order to ensure elastic linkage of two vertebral bodies resulting in good bonding with the bone and 2) after testing the first mode, a cage based only on the C/C composites was designed. It may be stated that the construction of the implant as a combination of a titanium alloy cage with a biologically favourable C/C composites solves the problems with the strength of the core whereas its biological benefit remains preserved. On the basis of mechanical tests and simulation of the strain of the spinal segments it was found that as a self-supporting component the C/C composite is not a material sufficiently suitable for the construction of intervetebral implants from the mechanical point of view.

COMPOSITE BIOTOLERANT IMPLANTS WITH A COLLAGEN-PROTEOGLYCAN COPOLYMER

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Abstract

Composite materials for medical applications proposed as substitutive or connective elements must satisfy all the demands for easy admission to the human organism. In general they must be biocompatible and their mechanical properties should approach as much as possible the properties of the human bone. Suitable basic composite materials based on carbon and glass fibers and polyethylene matrix with optimum values of mechanical parameters were prepared, stress analysis, surface analysis and tests "in vivo" the biotolerance and inhealing of the composites into the living tissue with the application of a collagen-proteoglycan copolymer were performed to reach desired physical and biomedical properties.

MATERIALS RESISTANT TO TEMPERATURE AND OXIDATION ON THE BASIS OF PYROLYZED POLYSILOXANES

Grant Poject of the Grant Agency of the Czech Republic

No. 104/00/1140

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Abstract

Silicon oxycarbides are modified quartz glasses , where some oxygen atoms are substituted by carbons. Likewise, some part of polyaromatic structures, so called “free carbon“, dispersed in the material is present. The lower fraction of the structures the better for high temperature application in oxygen atmosphere. The precursor type and treatment conditions have principal influence on free carbon fraction.

The oxycarbides were prepared by pyrolysis of polysiloxanes with different content of methyl and phenyl groups. Preparation of silicon oxycarbide glasses and structure changes of polysiloxane precursors during heattreatment in nitrogen atmosphere were studied. The “free carbon phase” was concentrated by hydrofluoric acid treatment.

Structure of the free carbon phase in three silicon oxycarbides was studied by FTIR and Raman spectroscopies, and by XRD. The oxycarbides were produced by pyrolysis of polysiloxanes with different content of methyl/phenyl groups at 1000 °C under nitrogen atmosphere. The free carbon phase is formed by sp^2 graphene planes merged in sp^3 structures. Its content and positioning in the SiOC network and its structural pattern reflects the sp^2/sp^3 ratio of the source polysiloxanes.

EVALUATON OF CRITICAL STRESS-STRAIN STATE OF ROCKS BY ULTRASONIC EMISSION (LABORATORY STUDIES)

Grant Project of the Grant Agency of the Czech Republic

No. 205/00/1143

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Abstract

Measurements of deformation were carried out and the ultrasonic emission was monitored in terms of the Grant Project. In agreement with the objectives of the Project, laboratory experiments were conducted on rock samples of various mineralogical compositions and of various grain-size distributions (fine- and coarse-grained sandstones, granites, migmatites). Different loading patterns were applied to these samples: linear, stepwise, cyclic loading at different loading rates. The loading period (i.e. from the beginning of loading to total rupturing of the samples) ranged over four orders (from 10 minutes to 10 000 minutes).

The acting force, longitudinal and transverse deformations and ultrasonic emission (UE) were recorded during the experiments. The ultrasonic emission was monitored by a 4-channel ultrasonic device. The location of the ultrasonic signals (US), their energy and time series were determined using developed software. UE characteristics (migration of foci, mutual time and space interference of US origin, energy distribution, UE correlation parameters, fractal dimensions and extrapolation of time series on the basis of correlation analysis and neural networks) were correlated with the state of stress and deformation of rocks.

It was found that, if the loading exceeded 95% of the rock strength, mutual interference of micro-fracture occurrence and also significant decrease of fractal dimension (US foci cluster into a plane or linear formation) occur. The results of location, correlation and fractal analyses enable the weak parts of the rock volume to be predicted. The results of extrapolating UE series (based on methods of correlation and neural networks) make it possible to forecast the time when the total rupturing of the rock samples is to occur.

INVESTIGATION OF THE TRIGGERING FACTOR LEADING TO AN INCREASED LANDSLIDING IN THE CZECH REPUBLIC DUE TO ENORMOUS SATURATION OF ROCK ENVIRONMENT

Grant Project of the Grant Agency of the Czech Republic

No. 205/00/0665

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Abstract

Extreme precipitation of July 1997 caused not only extensive floods in the territory of Moravia and Silesia but even important rejuvenation of landslides in different regions of the Czech Republic. It was mainly in the engineering-geological region of Carpathian flysh where slope stability conditions were upset due to enormous water saturation of rock environment, and a large economic damage was registered. A project subsidised by the Grant Agency of the Czech Republic was initiated to throw light upon a set of factors that take part in the so called triggering mechanism of the increased occurrence of slides. The research came to the evaluation of the origin and development of slope deformations in flysh rocks in model localities of the Vsetínská Bečva River drainage area. Field monitoring of changes in stability conditions was organised at two localities. The effect of climate as of the principal triggering factor of landsliding was evaluated on the basis of the input data from Cretaceous and Tertiary rocks of the Bohemian Massif, from flysh of Western Carpathians, and also with the use of comparable data from SW Germany.

MINERAL COMPOSITION OF SEDIMENTS IN THE WATER RESERVOIRS AND THEIR CONTAMINATION

Grant Project of the Grant Agency of the Czech Republic

No.205/00/1052

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Abstract

It was established that the mineral composition of the sediments of the Ohře River and its water reservoirs is primarily formed by quartz, clay minerals, Ca and K feldspars and to a lesser extent by further minerals such as amphibole, calcite, lepidocrockite and others. This mineral composition is similar in all localities as the sediments have to a certain extent the same (identical) source material. An important role is also played by the homogenization of the material during transport. In this process the less stable minerals gradually disintegrate while the more stable ones remain, mainly quartz and phyllosilicates. Clay minerals are represented by kaolin and illite, to a lesser extent by chlorite and smectite or mixed structure illite -smectite. The minerals of the smectite group appear primarily in the tributaries from the region of the Doupovské Hory Mountains.

Examining the contamination of the sediments by trace elements, observable differences were determined between the bottom sediments in the midstream water reservoirs of the Ohře River (Kadaň, Nechranice), tributary reservoirs (Skalka, Jesenice, Stanovice) and comparative reservoirs (Jirkov, Přísečnice). The contamination values in the sediments of the reservoirs grow downstream and the most serious contamination was found out in the Kadaň and Nechranice water reservoirs. The highest recorded values of the elements were: As up to 400 ppm (median for water reservoirs is 96 ppm), Zn up to 100 ppm (315 ppm), Cd up to 5 ppm (1,9 ppm), Hg up to 1,1 ppm and 4,7 ppm in the Skalka water reservoir (median for water reservoirs is 0,3 ppm). The contamination has its origin in the tributaries from the region of the Krušné Hory Mountains with its past mining activity as well as in the emission fallout in the period before desulphurization of coal power plants in this region. Recent analyses showed a considerable decrease in As content, on the other hand Pb content has increased.

CONCEPTUAL MODEL FOR URANIUM MINERALIZATION AT THE ROŽNÁ DEPOSIT

Grant Project of the Grant Agency of the Czech Republic

No.205/97/0679

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Abstract

Distribution of REE-U-Th in hydrothermally altered metamorphic rocks at the Rožná uranium deposit is controlled by various alterations (graphitization, albitization, carbonatization and episyenitization). Compared to unaltered rocks, the most important changes in U, Th and REE contents were found in mineralised albite-rich and carbonate- or chlorite-rich episyenites. For main stage of uranium mineralization is significant high amount of coffinite, which prevails about uraninite. For this mineralization is also characteristic presence of a mixture U-Ti-Si and U-Zr minerals and occurrence of newly formed monazite of the Permian age (268±31 Ma).

ACCESSORY MINERALS OF Ti, Nb, Ta AND W AS INDICATORS OF GEOCHEMICAL EVOLUTIONS IN MAGMATIC ROCKS AND RELATED AND HYDROTHERMAL SYSTEMS OF THE BOHEMIAN MASSIF

Grant Project of the Grant Agency of the Academy of Sciences of the Czech Republic

No A3046002

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Compositional variation was studied in columbite-group minerals from the beryl-columbite pegmatite at Scheibengraben, Maršíkov, Northern Moravia, Czech Republic. The pegmatite consists of five textural-paragenetic units, from the least to the most evolved: volumetrically dominant coarse-grained unit, subordinate graphic and blocky units and a minor cleavelandite unit; a saccharoidal albite unit is rather randomly distributed within the dike. It replaces and/or crosscuts all other units except the cleavelandite unit. Columbite-group minerals are the dominant Nb,Ta-oxide phases in all units. They are associated with other Nb,Ta-oxide minerals: minerals of the pyrochlore subgroup and fersmite in the coarse-grained unit, and minerals of the microlite subgroup, ferrotapiolite and rynersonite in the cleavelandite unit.

Dark brown porous ferrotapiolite is a dominant alteration product in pseudomorphs after primary stibiotantalite from the lepidolite pegmatite at Laštovičky, western Moravia, Czech Republic. Two compositionally distinct varieties of ferrotapiolite were recognized - volumetrically dominant Fe^{3+}-rich and very rare Sb-rich, respectively. Stibiotantalite is replaced by ferrotapiolite along irregularly distributed fractures according to the reaction - $2SbTaO_4 + Fe^{2+} = FeTa_2O_6 + 2Sb^{3+} + 2O^{2+}$. Such a significant Fe-enrichment documented by abundant secondary ferrotapiolite from Laštovičky is exceptional in secondary replacement products after primary Nb,Ta-oxide minerals in granitic pegmatites.

PETROLOGY AND MINERALOGY OF THE NEOLITHIC AND AENEOLITHIC ARTEFACT IN BOHEMIA

Grant Project of the Grant Agency of the Academy of Sciences of the Czech Republic
No A3407001
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Abstract
The fragments of Neolithic and Aeneolithic tools were found among artefacts from archaeological sites in the Czech Republic. We have studied several possible occurrences of a primary source of the raw material for the tools. The rocks as eclogite, porcellanite, amphibolite and spilite were studied in testing group of the tools. In the year 2002 we finished our work successfully. We discovered mining area of the amphibole hornfels near Jistebsko in the Northern Bohemia, Czech Republic.

HOLOCENE EVOLUTION OF THE SOIL COVER OF THE PROTECTED LANDSCAPE AREAS OF THE CZECH REPUBLIC

Grant Project of the Grant Agency of the Academy of Sciences of the Czech Republic
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Abstract
A network of soil profiles represent the database and long-term standard for the monitoring of soil cover changes in the Protected Landscape Areas of the Czech Republic. The soils were characterized on the basis of detailed analyses of individual soils and was defined the basic features their Holocene evolution. The most widespread soil type in the studied protected areas is Cambisol. The comparison of individual soil types in the protected areas and agriculture landscape are showed that the evidence of anthropogenic factor in the pedogenesis in the Holocene is the most notably in the Luvisol.

DESCRIPTION OF SEISMIC EXCITATION FOR THE AIM OF SAFETY ASSESSMENT OF STRUCTURES

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Abstract
Applications of the methods of stochastic mechanics on the analysis of seismic excitation and on the selection of parameters characterizing the excitation from the viewpoint of damaging the buildings and other structures. Methods of artificial excitation generations representing real risk of damage. Compilation of digital database of macroseismic observations with reference to near-surface geology and determination of corresponding relations.