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ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.14.018.29:621.78:669.017.3

Austenite pretransformation and transformation phenomenons in constructional steel heat treatment. Muraviev V. I., Frolov A. V., Kirikov A. V., Martyniuk A. M. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 7–14.

The paper presents results of studies of the effect of the austenization temperature on chromansil (30XГCA) pretransformation period. It is shown that the temperature and duration of isothermal hardening time at austenitizing hardened steel can widely vary the structure and mechanical properties of the steel, and form a dislocation structure with a high degree of defects concentration and its optimal allocation. The values of the optimal conditions of temperature and time of finishing austenitization are determined, allowing to control mechanical properties of steel and get a combination of high strength and raised fracture toughness; as well as highest plasticity.

Key words: heat treatment, rehardening, fast austenization, chromansil (30XГCA), austenite pretransformation, acoustic emission, Gibbs energy.

UDC 669.14.018:539.374

Abnormal length variations in dilatometric samples of austenitic corrosion-resistant, nitrogen-doped steel, under the changes in the rate of heating or cooling. Gromova N. B., Yampolsky V. D. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 15–23.

Volume change of dilatometric samples of corrosion-resistant, non-magnetic, nitrogen-doped 04H20N6G11M2AFB (04X20H6Г11M2AФБ) steel during plastic deformation under the influence of mechanical and thermal stresses in the temperature range 20–1200°C, passes two stages: 1) excess of microsities with increased (or decreased) microvolume relative to the original, which leads to microstrain compression (or tension), respectively, and 2) microsities relaxing by microplastic deformation with reduced (or increased) microvolume seeking to reduce the total change to minimum. Interconnected microprocesses are diffusionless.

Key words: corrosion-resistant, non-magnetic nitrogen-doped steel; dilatometric samples; volume change, plastic deformation.

UDC 669.14.018.8:621.785.3:539.389

Recrystallization behavior of deformed austenite steel 10Kh18N10 (10X18H10). Viktorov N. A. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 24–28.

10Kh18N10 (10X18H10) steel recrystallization after deformation (stretching with speed $\dot{\epsilon}_1 = 3,3 \cdot 10^{-3} \text{ s}^{-1}$, required level of 1 to 16%) has been studied at 800 and 950°C and after three cycles of annealing. At 800°C metal weakening goes by the mechanism of polygonization, recrystallization proceeds at 950°C. It is established, that after the first annealing (1050°C, 30 min) grain growth occurs from separate heating in metal deformed at 950°C, after the second annealing repeated recrystallization takes place, and after the third cycle structure of annealed austenite is being formed. The paper recommends forming optimal structure by slow cooling in a press to 800–850°C after deformation.

Key words: 10Kh18N10 (10X18H10) steel, strain rate, deformation degree, stretching, repeated recrystallization, cyclic annealing.

UDC 666.3

Composite materials: cubic boron nitride – silicon carbide – silicon. Gordeev I. S., Ordanyan S. S. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 29–37.

The paper investigates ceramic materials CBN–SiC–Si obtained by non-shrink technology, with sufficient bending strength comparable to silicon carbide ceramics and erosion resistance, significantly higher. It is shown that the materials cubic boron nitride – silicon carbide – silicon complete the range of ceramic materials, such as RBSiC, obtained by non-shrink technology, and successfully combine a set of physical and chemical properties of their constituent phases.

Key words: ceramic materials CBN–SiC–Si, non-shrink technology, physical and chemical properties.

UDC 661.665:666.3.0175

Interaction of silicon carbide with cerium and gadolinium hexaborides. Ordanyan S. S., Nesmelov D. D., Vikhman S. V. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 38–42.

The structure of SiC–CeB₆ and SiC–GdB₆ polythermic sections in corresponding four-component systems is investigated. Below the temperature of peritectic reactions these sections are described by eutectic phase diagrams: for SiC–CeB₆ $T_{\text{eut}} = 2020 \pm 20^\circ\text{C}$, 55 mol. % SiC, 45 mol. % CeB₆; for SiC–GdB₆ $T_{\text{eut}} = 2040 \pm 20^\circ\text{C}$ 60 mol. % SiC, 40 mol. % GdB₆. Information on the phase equilibria in multicomponent systems SiC–LnB₆ is necessary to obtain composite materials with desired properties. Eutectic phase diagrams ensure reduction of the melt appearance temperature, and, consequently, the sintering temperature.

Key words: silicon carbide, cerium hexaboride, gadolinium hexaboride, eutectic, composite material, functional ceramics, machine-building ceramics, cathode.

UDC 661.866. 2:666.3.017

Polythermic section B₄C–GdB₆ in ternary system Gd–B–C. Ordanyan S. S., Nesmelov D. D., Vikhman S. V. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 43–46.

The structure of B₄C–GdB₆ polythermic section in ternary system Gd–B–C has been investigated. The section is described below the melting temperature of B₄C and peritectic reaction of GdB₆ by eutectic phase diagram with $T_{\text{eut}} = 2100 \pm 20^\circ\text{C}$, 61 mol. % B₄C, 39 mol. % GdB₆.

Key words: boron carbide, gadolinium hexaboride, eutectic, composite material, functional ceramics, machine-building ceramics, cathode.

UDC 621.762.242:661.665

Magnesium-thermal synthesis of tungsten carbide in alkaline metal carbonate melts. Gostishchev V. V. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 47–51.

Method of tungsten carbide powder synthesis by means of magnesium-thermal restoration of tungsten oxygen compositions (WO₃) and carbon oxygen compositions (CO₂) in lithium, sodium and calcium melts media at temperature 1073–1273°K is developed and considered in this paper. It was experimentally determined that maximum efficient formation of tungsten carbide (97%) was observed in lithium carbonate melt. Specific surface of powders was also determined, it was as follows: $4,08 \cdot 10^5 \text{ m}^{-1}$ (Li₂CO₃) and $11,55 \cdot 10^5 \text{ m}^{-1}$ (K₂CO₃).

Key words: tungsten carbide powder, melt, alkaline metal carbonates, synthesis method.

UDC 678:539.37

Shear compliance and related strain electromagnetic properties in different physical states of densely cross-linked polymers. Theory. Ulitin N. V., Deberdeev T. R. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 52–56.

In the framework of the heredity theory a mathematical model of related viscoelastic and electromagnetic properties of densely cross-linked polymers has been developed. It's the first time that these properties are formalized in all physical states of densely cross-linked polymers due to presenting instant components of shear compliance and strain electromagnetic susceptibility as weight coefficients.

Key words: related viscoelastic and electromagnetic properties, cross-linked polymers.

UDC 678:539.37

Shear compliance and related deformation electromagnetic properties in different physical states of densely cross-linked polymers. Testing of theory on epoxy-amine polymers. Ulitin N. V., Deberdeev T. R. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 57–67.

In order to confirm the mathematical model of related viscoelastic and electromagnetic properties an experimental determination of the model constants is carried out for synthesized series of epoxy-amine polymers. A dependence determining the bond between the average τ -relaxation times and fraction of fluctuating free volume in all physical states of densely cross-linked polymers is analytically derived and experimentally corroborated. The behavior of thermomechanical and thermo-optic processes in different temperature regimes is predicted and confronted with experiment based on model constants values calculated using experimental data.

Key words: related viscoelastic and electromagnetic properties, cross-linked polymers, free volume.

UDC 678:539.37

Viscoelastic and strain electromagnetic properties of cross-linked polymers with a high frequency of mesh sites control. Numerical experiment based on theoretically calculated parameters. Ulitin N. V., Deberdeev R. Ya., Deberdeev T. R. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 68–76.

The methodology of theoretical estimation of constants for a new model of interrelated viscoelastic and electromagnetic properties of densely cross-linked polymers has been developed and tested. An experimental corroboration of numerical experiments has been obtained to predict relaxation processes' behavior.

Key words: densely cross-linked polymers, viscoelastic and strain electromagnetic properties, theoretical estimation.

UDC 678.746:22:539.4

Usage of bentonites of Berezovsky deposit for modification of impact resistant polystyrene. Lifanov A. D. – Voprosy Materialovedeniya, 2012, N 3 (71), p. 77–80.

The influence of Berezovsky deposit bentonite lamellar fillers modified by quaternary aluminium layers upon strength-deformation and operating properties of impact resistant polystyrene based on rubber – styrene system was studied. Structure and thermostability of filled composites was investigated using X-ray diffraction method, thermo-gravimeters and differential scanning calorimetric methods. It was shown that composites containing 1–5 weight fractions of bentonite are characterized by the best complex of properties.

Key words: composites, lamellar fillers, bentonites, modifying (modification), polystyrene, structure, thermostability.