GREEP. STRESS RUPTURE AND STRAIN HARDENING

Exercise 1. Answer the questions:

1. What temperature does a creep show up at under the action of quiescent load?
2. What standard is used in tests on a creep?
3. Which is a level of loading in the test of creep of grey cast-iron?
4. What is working temperature range for aluminum alloys?

New words and expressions:

- Melting point – точка плавления – еру нүктесі, межесі
- Elongate – расстягиваться – созылу
- Interplay – взаимодействие – әрекеттесу
- Gray iron – серый чугун – сұр шойын
- Stainless – нержавеющий – тот баспайтын
- Reinforced – армированный, усиленный – шыңдалған
- Vastmajority – подавляющее бльшинство – басым көпшілігі
- Tremendous – огромный – үлкен
- Stacking – накапливающийся – жинақталған
- Twinning – двойникование – қосарлану
- Severely – сильно – қатты
- Twisted – искаженный, скрученный – бұрмаланған

Exercise 2. Make up sentences using the following words and word combinations:

- To elongate continuously, face-centered cubic crystallographic structures, particular alloy steels.

- **Read text and discuss it:**

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As metals are exposed to temperatures within 40 percent of their absolute melting point, they begin to elongate continuously at low constant load (stresses beyond the proportional limit). A typical creep curve is a plot of the elongation against time of a wires subjected to a tensile load at a given temperature. Creep is explained in terms of the interplay between range from 20,000 lb/in. or more for particular alloy steels.

The usage range of temperature for steel ranges from – 460 F to almost 2000 F for specific stainless steels. Aluminum alloys can withstand temperatures from 300 to 500 F, and some titanium-reinforced polymers are useful up to 400 to 900 F, but the vast majority are good only to 200 F. Hardness is the most difficult property to use for making valid comparisons, because the deformation of plastics and elastomers under an indentor is different from that of metals. As a group, polymers are far softer than metals. Ferrous and nickel-base alloys range from 100 to 600 Brn, which is a tremendous range of values.

The strain-hardening behavior of a metal depends on its lattice structure. In face-centered cubic crystallographic structures, the rate of strain-hardening is affected by the stacking fault energy through its influence on mechanical properties. Copper, nickel and austenitic stainless steel strain-harden more rapidly than aluminum. Hexagonal close-packed metals are subject to twinning and strain-harden at a much higher rate than do other metals because there is only one plane of easy glide available in the close-packed hexagonal structure. Strain-hardening is also affected by grain size, impurity atoms, and the presence of a second phase. The strain-hardening rate increases with the complexity of the structure of the alloy.

Severely strained metal may have a elongated grains with distorted and twisted lattices and a strong anisotropy that can by an astute designer if he takes advantage of directional strength in his design. On the other hand, because of the increased strength and hardness brought about by strain-hardening, the number of reduction in a forming sequence will be limited before annealing is required.

Exercise 3. Complete the following sentences from the text

1. The usage range of temperature for steel ranges from …. to almost 2000 F for specific stainless steels.
2. Aluminum alloys can withstand temperatures from 300 to 500 F, and some titanium-reinforced ….. are useful up to 400 to 900 F, but the vast ….. are good only to 200 F.
3. ….. is the most difficult property to use for making valid comparisons, because the deformation of plastics and elastomers under an ….. is different from that of metals.
4. As a group, ….. are far softer than metals. ….. and nickel-base alloys range from 100 to 600 Brn, which is a tremendous range of values.

Exercise 4. Translate the sentences into Kazakh or Russian:

1. Hardness is the most difficult property to use for making valid comparisons, because the deformation of plastics and elastomers under an indentor is different from that of metals.
2. As a group, polymers are far softer than metals.
3. Ferrous and nickel-base alloys range from 100 to 600 Brn, which is a tremendous range of values.
4. The strain-hardening behavior of a metal depends on its lattice structure.