

October 30, 2015

Nonconventional materials  
Part 2. Intelligent materials

2015 Fall

Possible questions: without completeness

1. Classify the smart materials!
2. Classify the gels!
3. Define the polymer gels!
4. Classify the polymer gels based on their cross-linking nature, structure, etc!
5. Slide-ring gels: relationship between structure and properties.
6. Double network: relationship between structure and properties.
7. Ionically and covalently cross-linked hydrogel: relationship between structure and properties.
8. Nanocomposite hydrogel: relationship between structure and properties.
9. Define the interpenetrating polymer network!
10. Stimuli which are utilized in application of responsive gels.
11. Temperature responsive polymer hydrogel
12. Advantages of using light as controlling stimulus.
13. How responsive gels can be used in medicine? Drug delivery, nanomedicine, artificial skin.
14. Contact lenses
15. Superabsorbent hydrogels
16. Examples of independent control of multiple microvalves by local light irradiation.
17. Definition of shape memory effect.
18. Changes of crystal structure in SMAs: Temperature induced phase transformation without mechanical loading (diagrams!).
19. Changes of crystal structure in SMAs: Structural change upon a stress: detwinning (diagram!).
20. Changes of crystal structure in SMAs: Change in crystal structure after unloading and subsequent heating (diagram!).
21. Changes of crystal structure in SMAs: superelasticity (diagram!).
22. Methods of harnessing of the shape memory alloys with examples.
23. Bimetal or SMA?
24. Describe the shape memory effect in Shape Memory Polymers!
25. Permanent and reversible cross-links in Shape Memory Polymers.
26. Comparison of the properties of shape-memory alloys with shape-memory polymers.
27. Application of shape-memory polymers in surgery: examples.
28. Different types of magnetic behavior.
29. Variations in hysteresis curves: hard & soft magnets, superparamagnetic material.
30. Main forces appeared in ferrofluids.
31. Compare the ferrofluid, magnetorheological fluid and electrorheological fluid.
32. Behavior of neutral particles in electric or magnetic field.
33. How depends the viscosity of electrorheological fluid on the applied electric field?
34. Preparation of magnetic fluids: reducing the size (block diagram).
35. Preparation of magnetic fluids: chemical reaction (block diagram).

36. Ferrofluid in loudspeakers.
37. Biomedical application of ferrofluids.
38. Application of magneto-/ electrorheological fluids
39. Definition of piezoelectricity, electrostriction and magnetostriction.
40. Piezoceramics: what happens at the Curie temperature?
41. Piezoceramics: how does it work? Structure and properties correlations.
42. Poling of PZT piezoceramics.
43. Dielectric hysteresis of PZT piezoceramics.
44. Applications of the direct piezoelectric effect: sensors, ignition systems.
45. Applications of the direct reverse effect: acoustic devices, actuators.
46. Performance of the piezoelectric actuation. Compare piezoelectric ceramics with other intelligent materials.
47. Piezoelectric transducers.
48. Quartz crystal microbalance.