KF2380 Material Physics 7,5 hp

Material Physics

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

Fastställande

Kursplan för KF2380 gäller från och med VT09

Betygsskala

A, B, C, D, E, FX, F

Utbildningsnivå

Avancerad nivå

Huvudområden

Särskild behörighet

Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

Lärandemål

After the course the students should be able to: (i) describe the different physical (structural) states of polymers (crystalline, liquid-like, glassy and rubbery states); (ii) describe the relationship between chemical structure, molecular architecture and physical state of polymers; (iii) describe the conformational states of simple polymers and mastering calculation of conformational states of polymers as a function of temperature and goodness

of solvent; (iv) describe the principals for obtaining the conformational states of polymers in crystals; (v) describing and evaluating (in molecular terms) the elasticity of rubbery polymers; (vi) describe also in quantitative terms basic thermodynamic concepts for polymer solutions: bimodal concentrations, spinodal phase separation and interaction parameter; (vii) describe, understand shortcomings and apply Flory-Huggins mean-field theory for polymer solutions; (viii) use the solubility parameter concept in the calculation of solubility of polymers in low molar mass solvents. (ix) understand, derive and apply simple electron transport theory in metals, i.e. Drude theory and Hall effect, (x) understand and use results from combination of Maxwells' and Ohms' laws leading to e.g. skin effect and plasma- and cyclotron- frequency, (xi) understand and calculate simplified electrical effects in insulators, be able to classify materials with respect to polarization mechanism in materials, understand electron resonance and frequency dependence, (xii) elementary magnetism, understand and calculate simple quantities like saturation magnetization, coercivity, understand and apply simple domain theory, origin of magnetic anisotropy.

Kursinnehåll

This basic course in the physical sciences of materials covers polymers (focus area in this course), metals and ceramics. The polymer division explains the structure of the polymer molecules (conformation) on the basis of the atomistic and repeating unit structure. The conformational structure is then the basis of the stress-strain behaviour of rubbery materials and the performance of polymer solutions. The metal-ceramic part is focused on: electrical transport in metals like e.g. the Drude model, which, despite its obvious shortcomings, is a simple illustration of the development of an atomistic theory in materials science, hi frequency effects in conductors, electrical effects in insulators (despite the fact it is not a conductor), and an introduction to magnetic materials including some elementary calculations.

Kursupplägg

Labwork

The following three practical exercises are included:

1. Building polymer molecules and studying their conformations using computers.
2. Polymer solutions (polystyrene in cyclohexane)
3. Magnetic measurements

Kurslitteratur

‘Polymer physics’, 2nd edition, Ulf W. Gedde and Mikael S. Hedenqvist (to appear, Springer Verlag); pdf’s of chapters for 2008.

‘Electronic properties of engineering materials’, James D. Livingston, Wiley, ISBN 0-471-31627-X, Kårbokhandels, 585 SEK. Ch1-ch5

Examination

- LAB1 - Laboratory Work, 1,5 hp, betygsskala: P, F
- TEN1 - Examination, 4,0 hp, betygsskala: A, B, C, D, E, FX, F
- ÖVN1 - Exercises, 2,0 hp, betygsskala: P, F

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

ECTS-grades based on results from examination and from the laboratory course.

Övriga krav för slutbetyg

Examination (TEN1) 4.0 credits
Excersise (ÖVN1) 2.0 credits
Laboratory course (LAB1) 1.5 credits

Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.