Tfy-3.468 Surface Physics

Examination **15.12.2008**

1. Explain shortly what is
   a) Surface plasmon
   b) Incommensurate structure
   c) Surface energy

2. Iridium is a fcc metal with a lattice constant of 3.84 Å.
   a) Calculate the atomic density of the Ir(100) surface.
   b) Sketch the LEED pattern of the unreconstructed surface.
   c) The Ir(100) surface undergoes a reconstruction to Ir(100)-(5x1) structure. Sketch the LEED pattern from this surface.

3. Most of surface sensitive techniques are used in vacuum conditions. Why is the vacuum needed, and what is a proper vacuum for surface studies? Start your reasoning from the kinetic gas theory.

4. a) How does a scanning electron microscope work and what can be studied with it?
   b) How does a scanning tunneling microscope work and what can be studied with it?

5. What are the different mechanisms for film growth on single crystal surfaces? How can the growth be studied?

Informaatio- ja luonnontieteiden tiedekunta
Teknillisen fysiikan laitos

(Pyydetään palauttamaan)

VAKIOIDEN ARVOJA

Planckin vakio	h	=	$6{,}6262 \cdot 10^{-34}$ J s = $4{,}136 \cdot 10^{-15}$ eV s
$h/2\pi$	$\hbar$	=	$1{,}055 \cdot 10^{-34}$ J s = $0{,}6582 \cdot 10^{-15}$ eV s
Valon nopeus tyhjiössä	c	=	$2{,}99792 \cdot 10^{8}$ m s^{-1}
	hc	=	$1{,}240 \cdot 10^{-6}$ eV m
Alkeisvaraus	e	=	$1{,}6022 \cdot 10^{-19}$ C (1 C = 1 A s)
Tyhjiön permeabiliteetti	μ_o	=	$4\pi \cdot 10^{-7}$ H m^{-1} (1 H = 1 V s A^{-1})
Tyhjiön permittiivisyys (permittiviteetti)	ε_o	=	$8{,}8542 \cdot 10^{-12}$ F m^{-1} (1 F = 1 A s V^{-1})
Avogadron vakio	N_A	=	$6{,}0220 \cdot 10^{23}$ mol^{-1}
Kaasuvakio	R	=	$8{,}3144$ J mol^{-1} K^{-1}
Boltzmannin vakio	k	=	$1{,}3807 \cdot 10^{-23}$ J K^{-1}
Stefanin ja Boltzmannin vakio	σ	=	$5{,}670 \cdot 10^{-8}$ W K^{-4} m^{-2}
Rydbergin vakio	R_∞	=	$10{,}97373177 \cdot 10^{6}$ m^{-1}
Atomimassayksikkö	u	=	$1{,}6605655 \cdot 10^{-27}$ kg = 931,50 MeV/c^2
Gravitaatiovakio	G	=	$6{,}672 \cdot 10^{-11}$ N m^2 kg^{-2}
Normaaliputouskiihtyvyys	g	=	$9{,}80665$ m s^{-2}
Elektronin massa	m_e	=	$9{,}10953 \cdot 10^{-31}$ kg = 0,00054858 u
	$m_e c^2$	=	0,5110 MeV
Protonin massa	m_p	=	$1{,}6726485 \cdot 10^{-27}$ kg = 1,0072765 u
	$m_p c^2$	=	938,28 MeV
Neutronin massa	m_n	=	$1{,}6749543 \cdot 10^{-27}$ kg = 1,0086650 u
	$m_n c^2$	=	939,57 MeV
Deuteronin massa	m_D	=	$3{,}3436370 \cdot 10^{-27}$ kg = 2,0135532 u
	$m_D c^2$	=	1875,63 MeV
α-hiukkasen massa	m_α	=	$6{,}6447631 \cdot 10^{-27}$ kg = 4,0015062 u
	$m_\alpha c^2$	=	3727,41 MeV
Bohrin vetyatomin säde	a_o	=	$5{,}29177 \cdot 10^{-11}$ m
Comptonin aallonpituus elektronille	λ_C	=	$2{,}4263 \cdot 10^{-12}$ m
Bohrin magnetoni	μ_B	=	$9{,}2741 \cdot 10^{-24}$ J T^{-1}
Ydinmagnetoni	μ_N	=	$5{,}0508 \cdot 10^{-27}$ J T^{-1}

Auringon säteilyn intensiteetti Maan etäisyydellä ilmakehän ulkopuolella (solaarivakio) 1,35 kW m^{-2} (1,3...1,4 kW m^{-2} vuodenajasta riippuen)

Veden ominaislämpö(kapasiteetti) 4,19 kJ kg^{-1}K^{-1}

Veden sulamislämpö (101,3 kPa) 334 kJ kg^{-1}

Veden höyrystymislämpö (100 °C, 101,3 kPa) 2256 kJ kg^{-1}