Contents

1 1st talk (권석준, 성균관대)

1.1 Limit of modern nano-electronics - no reliable light source, monochromatic process of under 13.5nm light source

keywords

keywords	BCP(Block CoPolymer)	topological defect	measurement complexity
hermans parameter	configuration entropy	MFEP	Minimum FreeEnergy Path
fluctuation	temperature	computational design	recipie finding with ML

overcome effort - using complexity

1. controlling defect » need for understanding of complexity and the technology of control » entropy, enthalpy

PS blush layer » »ordered state(crystal state) » disordered state(liquid state)

1. small-angle scattering based method (inspection of nano patterns)

2. measurement of complexity of nano-scale patterns - orientaional order

Angular distribution = hermans parameter = spatial distribution

1. topological defect detedtion (연결될 것이 끊겼다든지, 끊겨야 될 것이 연결되는 등 위상수학적 결함)

SEM image, reciprocal transform & bragg filter - image processing with convolution kernel

1. Line Edge Roughness & line width roughness - SPU(Stripe Pattern Uniformity): complementary for LER or LWR

determination of orientation : Gabor filtering

1. configuration entropy

entropy based on image (2D pixel matrix) - uncertainty of binary digital code shanon entropy (information entropy) - 기본적으로 0,1 갯수만 구별하지 패턴은 구별 못 하는데, 이를 극복하기 위해 패턴별로 코드를 만들고 각 패턴의 발생빈도를 새서 entropy를 측정한다.

entropy based on coordinate - graph isomorphysm » calculate isomorphysm number per unit area

1. stealthniss index
2. for the fully understanding of complexity of BCP, we have to use each method for comlementory
3. if we extract the parameters metioned above, and if we use ML then we can know how to control SEM
4. computational design

ex) bulk density, frequency of delta T(fluctuation of temperature) makes diverged patterns of copolymer

controlling of topological defect by fluctuation of temperature, (MFEP method) soft potential

1. pseudo particle generator, photonic crystal generated by defect control & shape control

Q1 . BCP fabrication - A1. spincoating and post-annealing. thickness is important for patterning and the thickness has to be affected by material itself. case of line pattern, under 22nm 2D but over 22nm it made 3D shape need also surface treatment

Q2. ODP를 많이 보셨느데, OO는 어떻게 보시는지? A1. OO는 실제로 본 적이 없습니다.

2 2nd talk (우석우, 포항공대)

2.1 DNA-based self-assembly towards programmable nanoscale patterning

keywords

DNA origami   hierachical assembly   tubulin DNA ring   20nm scale pattern

intro - how to build thing : top-down or bottom-up SAM limit - hard to control, traditional bottom-up limit - too slow

DNA is programmable structure » DNA origami (generalized programming method of DNA) folding huge size of Scaffold with short staples (res 6nm alphabet is possible to write)

bacterial flagellum(박테리아 꼬리 부분) , covid19 바이러스 - 굉장히 정교한 구조 simple interation via hierachical assembly high reliable and controlled assembly

Hierachical assembly(Woo S & Rothemund P.W.K Nat Commun 5.4889.(2014) link 200nm 10X10 check pattern each has ~20nm surface diffusion assembly twist-corrected method

Controll of DNA structure Microtubules(MTs) - In vitro reconstruction » poor result controlled tubulin DNA ring by seeding DNA on the inorganic MTs and growth MTs with a controlled & homogenous diamter by functionalized DNA» MT 'doublets'

3D origami seed

conclusion DNA technology - Bridge to nano tech & micro tech microfabrication with nanoscale features

Q1. 스케일링 업에 대해서 어떻게 생각하느냐? A1. DNA origami on Si, and orientation allign has been achived recently

3 3rd talk (정운룡, 포항공대)

3.1 Microparticle-based patterning and fabrication of deformable devices

keywords

particle embeding	functionalized particle	BCP matrix	position registry
large area uniform	orientation control	stretchable	

adv.funct.mater 2019 30 1901810 - functionalized particle between or on the electric device link
1st issue - how functionalize, 2nd - how to position, 3rd - how to apply to device
why? make rigid deformable, anisotropic onductive film, bottom-up devices
particle embeded in BCP matrix sysnthesis » position registry » device system » integrated devices

1. synthesis - conductive or magnetic particle » uniform metal coated polymer particle is most useful

2. position registry(self assembly) - defect problem - solvent evaporation makes spatial defficiency and it makes uncontrollable defect

hydrophilic particle monolayer on water surface: dispersion of particle in EtOH and then dispose to water surface » defect problem, multiple grains » need forced assembly » making pattern by lithography and deposit particle, but expensive and too sensitive » park & jeong et al adv mater (2014) 26,4633 (rubbing particle on the PDMS) link

calculate hamaker constant and JKR theory, tack energy(viscocity) dependency on coordination number. over 130nm sphere particle is well fabricated by the rubbing method

orientation change (grain control) by rubbing direction (sci.report 2015,5,8340) link patterning by rubbing method wafer scale monolayer by one directional rubbing (disposal of grain defect but still point defect)

acs app lmater interfaces 2015 kho and jeong patterned PDMS and apply rubbing method

adv funct.mater 2018 1801858 you & jeong - use lithography for positioning, and making devices using MPs as sensor link

1. device system (stable system)

stretchable, adhesive, simple switching, circuit-MCU interface, cross-talk(각 픽셀끼리 간섭하는 정도를 나타내는 척도) sci advances 2021 eabh0171, hwang kong jeong - stretchable ACF (잡아당겨도 전기저항의 변화가 거의 없는 stretchable substrate)link

1. final purpose

small device + stretchable conduction line

Q1. rubbing 할 때 압력과 속도를 표시하셨는데, 이 수치를 어떻게 얻으셨는지? A1. 기계를 이용해서 systematic 하게 실험을 수행했다.

Q2. 열에 의한 영향은 없는가? A2. particle 자체의 degradation, 전극의 degradation 전극은 거의 영향을 안 받는다고 보면 된다. 다만 particle은 사용하는 material에 따라 열의 영향이 다르기 때문에 잘 선택해서 하면 된다.