ChE 384T/323 Quiz #7

October 4, 2018

Print Name: Ji Yeon Kim (Answer Key)

UTEID:

[4] 1. List two advantages that derive from ink jet dispense of imprint resist over simply spin coating the resist.

1) You can control the amount of liquid dispensed at different regions of the pattern so that the liquid does not have to ~~flow~~ travel too far

2) Reduce fill time. → waste a lot of resist solution

[4] 2. What is a flexure joint and why is it that only flexures are used in the design of the "head" that holds the imprint template.

② To ensure that the mask is self-levelled & hence, it will ~~apply same force~~ be in uniform contact ③ (parallel to the surface) flat and with the resist.

→ Holds the imprint template ① ~~flat and parallel to the surface~~
- Can be bent
- doesn't introduce dust unlike metal shafts.

[2] 3. What causes birefringence in CaF_2 crystals

crystalline, causes changes in refractive index at different polarization ~~[illegible]~~ of light

P.S. and FYI, I was going to ask you to tell me about piezoelectric materials but decided not to do that….

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ChE 384T/323 Quiz #8

October 10, 2018

Print Name: Ji Yeon Kim (Answer Key).

UTEID:

4

1. What is "shot noise". Please use no more than 3 complete sentences to provide your answer.

shot noise is a type of noise phenomenon emerging from the discrete energy nature of particles. At low intensities, shot noise can be observed causing image graininess leading to image resolution degradation.

2. The members of the 4 x 100 relay team each run 100 yards and their accumulated time is compare to that of other 4 member teams. If three of the members of our team can run 100 yards in 10.5 seconds and one can only make that distance in 11 seconds, is the slower runner the "rate limiting step"? Please explain you answer in no more than tree sentences.

3

No, . If any of the runners went faster or slower the total time would be affected!

3

3. Proximity correction is required to achieve acceptable pattern quality in high-resolution electron beam lithography. What fundamental process is responsible for having to do proximity correction?

Electron Scattering

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ChE 384T/323 Quiz #~~10~~ 11

November 6, 2018

Print Name : ______________________________

UT EID : ______________________________

4 1. What do we need to control when doing pattern transfer? Please list 4 variables.

anisotropy
sidewall angle/ feature profile
CD
etch rate
repeatability
uniformity
etch selectivity
(Steve's slides)

4 2. How is anisotropic etching achieved?

- Boundary layer sheath formation
- accelerate ions but repels electrons
- Activation Energy

2 3. What do ALE and ALD stand for?

Atomic layer ~~etching~~ etching

~~Atomic layer deposition~~

Atomic Layer deposition

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ChE 384T/323 Quiz #12

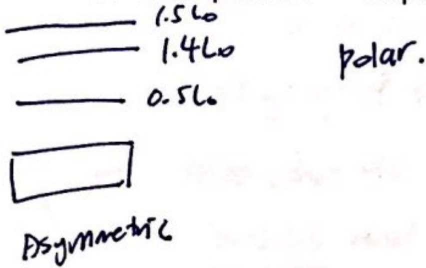
November 8, 2018

Print Name: Answerkey

UTEID:

4

1. A high χ block copolymer was prepared and a film of this material was coated on a substrate to a thickness of 1.4 L_o. The film was annealed and when it was examined by optical microscopy, "holes" were observed. Was the substrate polar or non-polar? Explain your answer. You may use a sketch.

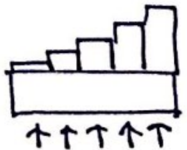


polar.

3

2. Why must one negative tone optical resists on transparent substrates. You may use a sketch.

exposing from the back through a transparent substrate allows such that ~~the~~ what is exposed becomes insoluble & the unexposed top layer of the resist can be washed away. If the top is insoluble, we cannot get any dose contrast curve



3

3. What does the term conformable mean when used to describe a coating? You may use a sketch

Conforms / follows the shape of the substrate pattern in all directions. with uniform thickness.

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ChE 384T/323 Quiz #13

November 29, 2018

Print Name: Key

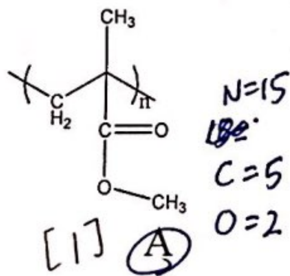
UTEID:

Polyphthalaldehyde resist is a very sensitive imaging system because it incorporates two stages of "chemical amplification". Please describe the two different stage of gain in this system.

[2.5] — PAG → photoacid
acts as a catalyst and can attack many of the end group of polyphthalaldehyde polymer chains

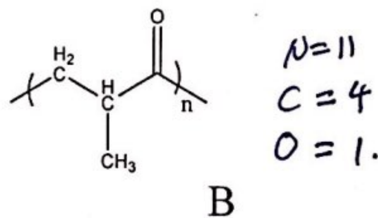
[2.5] — ~~The~~ When the end group breaks, the ~~unzipp~~ polymer unzips and propagates down the whole chain.

2. Please predict which polymer will etch at the highest rate in oxygen RIE. Explain your answer on the basis of the Ohnishi numbers.



N=15
C=5
O=2

[1] (A)



N=11
C=4
O=1.

B

~~more oxygen~~. ohnishi # $= \frac{N}{N_c - N_o}$ ↑ ⇒ ↑etch rate

$= \frac{15}{3}$

$= 5$ [2]

$= \frac{11}{3}$

$= 3\frac{1}{3}$. [2]

partial credit given

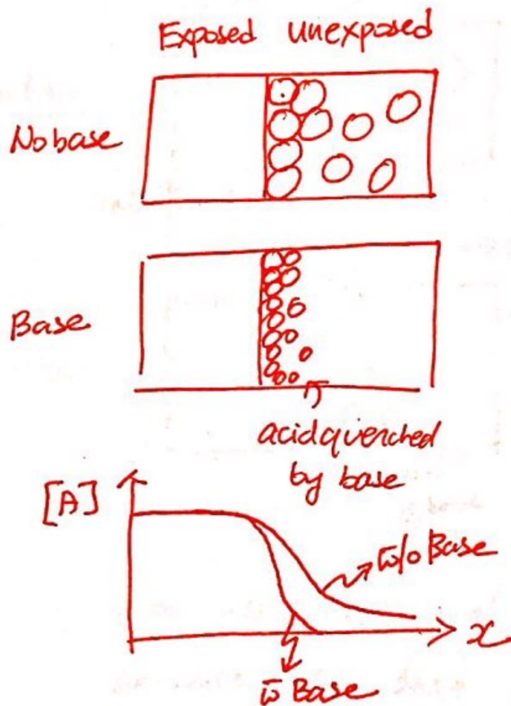
ChE 384T/323 Quiz #14

December 4, 2018

Print Name: Key

UTEID:

1. Please explain how adding base to an acid catalyzed, chemically amplified resist reduces line edge roughness. You may want to employ figures in your explanation, but that is not a requirement.



Keywords:

- reduces the acid's sphere of influence
- quench/neutralize acid
- less diffusion

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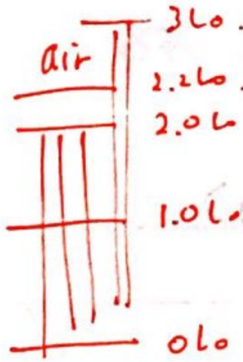
Quiz 9 Answer Key

1)

5



Islands

Symmetric wetting
⇒ nonpolar

assuming it is silicon containing BCP
assuming it is full islands.

2)

5

interaction parameter. b/w 2 blocks. [2.5]

higher the χ, the more it hates each other. [2.5]