

TCAD講習会

課題1: Simple2Dの例題のSimple2D_des.cmdファイルで行っていること理解して説明せよ。

M1 五屋郁美

長さなどの定義

```
(sde:clear)

(define W 150)

(define Lstripe_pitch 50.0)

(define LNplus_stripe 30.0)
(define LGR_pitch 30.0)
(define LNplus_GR 15.0)
(define gap (- 10 (* 0.5 (- LGR_pitch LNplus_GR))))
;;(define gap 20.0)

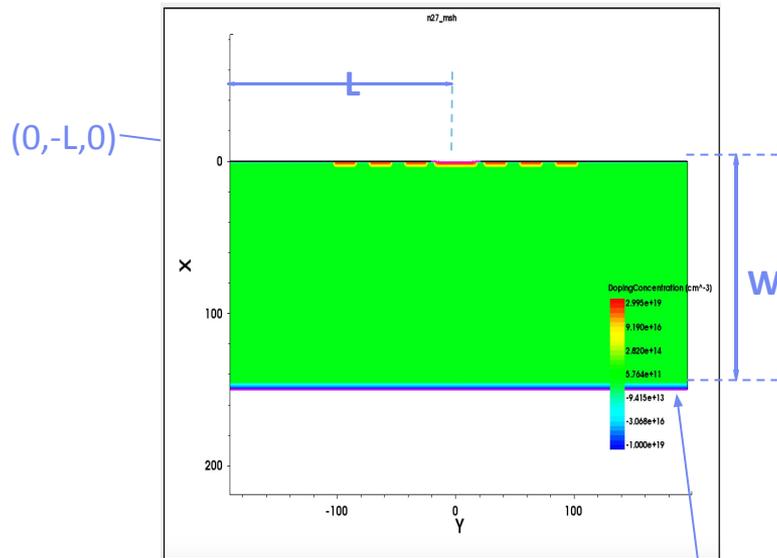
(define NSTRIPES @NumStripes@)
(define NGR 3)
(define Xj 4.0)

(define EXT 100.0)
(define L (+ (* NSTRIPES Lstripe_pitch) (* 1.0 gap) (* NGR LGR_pitch) EXT))

(define Plow 1e12)
(define Nca 1e19)
(define Pan 1e19)
(define pspray 5e16)

(sdegeo:create-rectangle (position 0 (- 0 L) 0) (position W L 0) "Silicon" "RSub")

(define end-active 0)
(define poslist (list))
```



長方形を置く

n+のドーピングを設定

NSTRIPEが
偶数の場合

```
if (eq? (modulo NSTRIPE 2) 0)
  (begin
    (define j 1)

    (
      do ((i 1 (+ i 1))) ((> i (inexact->exact (* 0.5 NSTRIPE))))

      (define refevalname1 (string-append "RefVal_Nplus_" (number->string j) ))
      (define placename1 (string-append "Place_Nplus_" (number->string j) ))

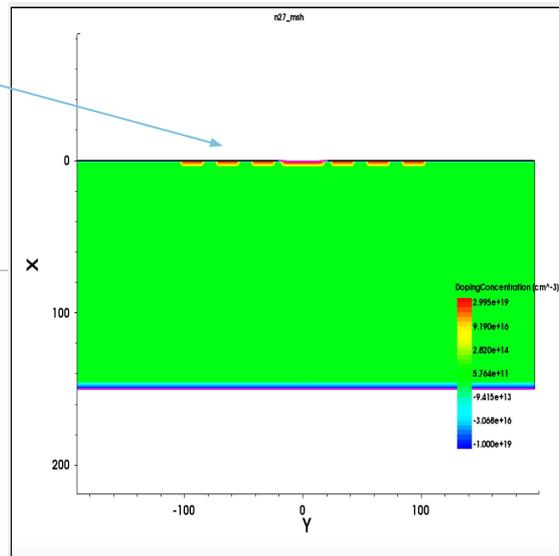
      (define refevalname2 (string-append "RefVal_Nplus_" (number->string (+ j 1)) ))
      (define placename2 (string-append "Place_Nplus_" (number->string (+ j 1)) ))
      (set! j (+ j 2))

      (define defname "Nplus")
      (sdedr:define-gaussian-profile defname "PhosphorusActiveConcentration" "PeakPos" 0 "PeakVal" Pan "ValueAtDepth" Plow "Depth" Xj "Gauss" "Factor" 0.8)

      (sdedr:define-refeval-window refevalname1 "Line"
        (position 0 (- 0 (+ LNplus_stripe (* 0.5 (- Lstripe_pitch LNplus_stripe)) (* (- i 1) Lstripe_pitch) )) 0)
        (position 0 (- 0 (+ (* 0.5 (- Lstripe_pitch LNplus_stripe)) (* (- i 1) Lstripe_pitch) )) 0)
      )
      (sdedr:define-analytical-profile-placement placename1 defname refevalname1 "Both" "NoReplace" "Eval")

      (sdedr:define-refeval-window refevalname2 "Line"
        (position 0 (+ 0 (+ (* 0.5 (- Lstripe_pitch LNplus_stripe)) (* (- i 1) Lstripe_pitch) )) 0)
        (position 0 (+ 0 (+ LNplus_stripe (* 0.5 (- Lstripe_pitch LNplus_stripe)) (* (- i 1) Lstripe_pitch) )) 0)
      )
      (sdedr:define-analytical-profile-placement placename2 defname refevalname2 "Both" "NoReplace" "Eval")

      (set! end-active (+ 0 (+ LNplus_stripe (* 0.5 (- Lstripe_pitch LNplus_stripe)) (* (- i 1) Lstripe_pitch) )) )
    )
  )
)
```



NSTRIPEが 奇数の場合

```
(begin
  (define j 1)
  (define defname "Nplus")
  (sdedr:define-gaussian-profile defname "PhosphorusActiveConcentration" "PeakPos" 0 "PeakVal" Pan "ValueAtDepth" Plow "Depth" Xj "Gauss" "Factor" 0.8)
  (sdedr:define-refeval-window "RefVal_Nplus_0" "Line"
    (position 0 (- 0 (* 0.5 LNplus_stripe)) 0)
    (position 0 (+ 0 (* 0.5 LNplus_stripe)) 0)
  )
  (sdedr:define-analytical-profile-placement "Place_Nplus_0" defname "RefVal_Nplus_0" "Both" "NoReplace" "Eval")
  (
    do ((i 1 (+ i 1))) ((> i (inexact->exact (* 0.5 (- NSTRIPE 1))))))
    (define refevalname1 (string-append "RefVal_Nplus_" (number->string j) ) )
    (define placename1 (string-append "Place_Nplus_" (number->string j) ) )
    (define refevalname2 (string-append "RefVal_Nplus_" (number->string (+ j 1)) ) )
    (define placename2 (string-append "Place_Nplus_" (number->string (+ j 1)) ) )
    (set! j (+ j 2))
    (sdedr:define-refeval-window refevalname1 "Line"
      (position 0 (- (* i Lstripe_pitch) (* 0.5 LNplus_stripe) ) 0)
      (position 0 (+ (* i Lstripe_pitch) (* 0.5 LNplus_stripe) ) 0)
    )
    (sdedr:define-analytical-profile-placement placename1 defname refevalname1 "Both" "NoReplace" "Eval")
    (sdedr:define-refeval-window refevalname2 "Line"
      (position 0 (- 0 (+ (* i Lstripe_pitch) (* 0.5 LNplus_stripe) )) 0)
      (position 0 (- 0 (- (* i Lstripe_pitch) (* 0.5 LNplus_stripe) )) 0)
    )
    (sdedr:define-analytical-profile-placement placename2 defname refevalname2 "Both" "NoReplace" "Eval")
    (set! end-active (+ (* i Lstripe_pitch) (* 0.5 LNplus_stripe) ) )
  )
)
```

```

(define begin-GR (+ end-active gap))
  (
    do ((i 1 (+ i 1))) ((> i NGR))

      (define refevalname1 (string-append "RefVal_NGR_" (number->string j) ) )
      (define placename1 (string-append "Place_NGR_" (number->string j) ) )

      (define refevalname2 (string-append "RefVal_NGR_" (number->string (+ j 1)) ) )
      (define placename2 (string-append "Place_NGR_" (number->string (+ j 1)) ) )
      (set! j (+ j 2))

      (define defname "NGR")
      (sdedr:define-gaussian-profile defname "PhosphorusActiveConcentration" "PeakPos" 0 "PeakVal" Pan "ValueAtDepth" Plow "Depth" Xj "Gauss" "Factor" 0.8)

      (sdedr:define-refeval-window refevalname1 "Line"
        (position 0 (- 0 (+ begin-GR LNplus_GR (* 0.5 (- LGR_pitch LNplus_GR)) (* (- i 1) LGR_pitch) ) ) 0)
        (position 0 (- 0 (+ begin-GR (* 0.5 (- LGR_pitch LNplus_GR)) (* (- i 1) LGR_pitch) ) ) 0)
      )
      (sdedr:define-analytical-profile-placement placename1 defname refevalname1 "Both" "NoReplace" "Eval")

      (sdedr:define-refeval-window refevalname2 "Line"
        (position 0 (+ 0 (+ begin-GR (* 0.5 (- LGR_pitch LNplus_GR)) (* (- i 1) LGR_pitch) ) ) 0)
        (position 0 (+ 0 (+ begin-GR LNplus_GR (* 0.5 (- LGR_pitch LNplus_GR)) (* (- i 1) LGR_pitch) ) ) 0)
      )
      (sdedr:define-analytical-profile-placement placename2 defname refevalname2 "Both" "NoReplace" "Eval")
    )
  )

```

電極を定義

```
(define listdcathode (get-drs-list))

(sdedr:define-refeval-window "RefEval_anode" "Line" (position W (- 0 (+ L 10)) 0) (position W (+ L 10) 0))

(sdedr:define-gaussian-profile "DopAnode" "BoronActiveConcentration" "PeakPos" 0 "PeakVal" Pan "ValueAtDepth" Plow "Depth" 5 "Gauss" "Factor" 0.8)
(sdedr:define-analytical-profile-placement "Place_anode" "DopAnode" "RefEval_anode" "Both" "NoReplace" "Eval")

(sdedr:define-refeval-window "RefEval_pspray" "Line" (position 0 (- 0 (+ L 10)) 0) (position 0 (+ L 10) 0))

(sdedr:define-gaussian-profile "Doppspray" "BoronActiveConcentration" "PeakPos" 0 "PeakVal" pspray "ValueAtDepth" Plow "Depth" 1 "Gauss" "Factor" 0.8)
(sdedr:define-analytical-profile-placement "Place_pspray" "Doppspray" "RefEval_pspray" "Both" "NoReplace" "Eval")

(define Tox 0.5)
(sdegeo:create-rectangle (position (- 0 Tox) (- 0 L) 0) (position 0 L 0) "Oxide" "Rox")

(define contlist (list))
  (define listbody listca)
  (for-each (lambda (body)
    (define start (edge:start (car (entity:edges body))))
    (define end (edge:end (car (entity:edges body))))
    (set! contlist (append contlist (list (position:y start))))
    (set! contlist (append contlist (list (position:y end))))
  )
  listbody)

(set! contlist (sort < contlist))

(define cc 1)
(do ((i 0 (+ i 2))) ((> i (- (length contlist) 1) ))
  (sdegeo:create-rectangle (position (- 0 Tox) (list-ref contlist i) 0) (position 0 (list-ref contlist (+ i 1)) 0) "Aluminum" (string-append "RAL" (number->string cc)))
  (entity:delete (find-region-id (string-append "RAL" (number->string cc) )) )
  (sdegeo:set-default-boolean "BAB")
  (sdegeo:create-rectangle (position (- 0 (+ Tox 0.1)) (- (list-ref contlist i) 5.0) 0) (position 0 (+ (list-ref contlist (+ i 1)) 5.0) 0) "Aluminum" (string-append "RAL" (number->string cc)))
  (sdegeo:define-contact-set (string-append "cathode" (number->string cc) ) 4 (color:rgb 1 0 0) "##")
  (sdegeo:set-current-contact-set (string-append "cathode" (number->string cc)))
  (sdegeo:set-contact-boundary-edges (find-region-id (string-append "RAL" (number->string cc) )) )
  (entity:delete (find-region-id (string-append "RAL" (number->string cc) )) )
  (sdegeo:set-default-boolean "ABA")
  (set! cc (+ cc 1))
)

(sdegeo:define-contact-set "anode" 4 (color:rgb 1 0 0) "##")

(sdegeo:set-current-contact-set "anode")
(sdegeo:set-contact-edges (find-edge-id (position W 0 0)))
```

n+が流れないように
psprayしている

酸化膜を定義

```

(set! xcutlist (sort < xcutlist))
(define newList (list))
(do ((i 1 (+ i 2))) (> i (- (length xcutlist) 2) ))
  (set! newList (append newList (list (* 0.5 (+ (list-ref xcutlist i) (list-ref xcutlist (+ i 1)))))))
)
(set! newList (sort < (append newList xcutlist)))
(sdeaxisaligned:set-parameters "xCuts" newList )

(sdedr:define-constant-profile "ConstantProfileDefinition_1" "BoronActiveConcentration" Plow)
(sdedr:define-constant-profile-material "ConstantProfilePlacement_1" "ConstantProfileDefinition_1" "Silicon")

(sdedr:define-refinement-size "RefinementDefinition_1" (* 0.1 L) (/ W 20.0) 1 0.05 0.05 0.05 )
(sdedr:define-refinement-placement "RefinementPlacement_1" "RefinementDefinition_1" (list "material" "Silicon" ) )
(sdedr:define-refinement-function "RefinementDefinition_1" "DopingConcentration" "MaxTransDiff" 1)

(define takemax (lambda(x y) (if (> (abs x) (abs y)) (define jj (abs x)) (define jj (abs y))) jj))

(define create-polygon-pos-list (lambda(name posx posy vv W L)
  (sdedr:define-refeval-window name "Polygon" (list
    (position (+ posy (* (gvector:x vv) W)) (- posx (* (gvector:y vv) W)) 0)
    (position (- posy (* (gvector:x vv) W)) (+ posx (* (gvector:y vv) W)) 0)
    (position (- (+ posy (* (gvector:y vv) L)) (* (gvector:x vv) W)) (+ (+ posx (* (gvector:x vv) L)) (* (gvector:y vv) W))0)
    (position (+ (+ posy (* (gvector:y vv) L)) (* (gvector:x vv) W)) (- (+ posx (* (gvector:x vv) L)) (* (gvector:y vv) W))0)
  ))
  (sdedr:define-refeval-window "Ref_fakeprofile" "Line"
    (position (+ posy (* (gvector:x vv) W)) (- posx (* (gvector:y vv) W)) 0)
    (position (- posy (* (gvector:x vv) W)) (+ posx (* (gvector:y vv) W)) 0)
  )
  (sdedr:define-erf-profile "fakeprofile" "PMIUserField99" "SymPos" L "MaxVal" 1 "ValueAtDepth" 0 "Depth" (+ L (* 0.5 W)) "Erf" "Length" (* 0.5 W))
  (sdedr:define-analytical-profile-placement "Place_fakeprofile" "fakeprofile" "Ref_fakeprofile" "Both" "NoReplace" "Eval")

  (sdedr:define-refinement-size (string-append "DEF_" name)
    (* 0.1 (takemax (* (gvector:y vv) W) (* (gvector:x vv) L)))
    (* 0.1 (takemax (* (gvector:x vv) W) (* (gvector:y vv) L)))
    1
    0.05
    0.05
    1
  )
  (sdedr:define-refinement-function (string-append "DEF_" name) "PMIUserField99" "MaxTransDiff" 0.1)
  (sdedr:define-refinement-placement (string-append "PLACE_" name) (string-append "DEF_" name) (list "window" name) )
))

(create-polygon-pos-list "REFION" @posX@ @posY@ (gvector @dirX@ @dirY@ 0) @whi@ @L@)

```