TO CRYSTAL STRUCTURE OF SOLIDS
PN striction acts as a diode when
we provide a bias to the terminals using a "connection"/electrodes
metal = [P N] = PN Diode  (conductor)
doped semiconductor
metal N-Mpe Schottky diode
Mos Transistor
metal oxide seniconductor  metal contact
nutallic contact GATE Intalic contact (glass)
n type  Body  n type
metallic & Ptype semiconductor Conductor (Silicon usually)
# CRYSTAL PHUSICS
MATTER  4 Gas 4 Liquid / Liquid orystals
4 Solid 4 Rlasma
Von-der-waal force interaction in gasses  Very weak potential  Torric/Covalent bonding in Solids
Silicon -> Sp³ tetravalent shucture
Interaction gives the idea of state of
mader ond its distribution  CARBON
Sp <sup>2</sup> Graphite -> metal Sp <sup>3</sup> 4 Diamond -> insulator 4 Buckminster - Fullerene -> semiconductor
Some element but displays different proparties bacause of different crystal
Grownie -
covalent {
single layer of Stacked graphile = graphere
Sp <sup>2</sup>
To bond  types of corclent bond
Rx Ry
Myboridization y This forms he van der waal
Diamond > all Px, Py, Pz form bonds
Buckminster-Fullerere > between sp2 & sp3
has hexagonal and pertagonal Shructure Super conductor
L) conducts electricity without one vesistance = zero resistance conduction
elactrical presistivity Tresistation Transfer
is it possible that 2e form a pair?
(usually) No, due to coulomb force, like charged particles have his repulsive force
60T at 0-50k temperature, the attractive force of e- is massive as compared to supplied forces and hence 2 e-form
a Cooper pair # Vonadium Dioxida VOz
Insulator Monoclinic Voz jas we increase the metal Rutile Voz temperature (culoic struct)
Just charging the temperature, charges the nature and
Structure of the crystal
Insulators don't have as man free e-
Trisulators don't have as many free e- as conductors  Trisulators have higher band only
Insulators don't have as man, free e- as conductors  This what have higher band gap  Conductors don't have band gap
Trisulators have higher band gap  Conductors don't have band gap  distance between and conduction band and
Insulators have higher band gap  Conductors don't have band gap  distance between and conduction band and valence band  Mean Free Path: The distance are - travels
Insulators have higher band gap  Conductors don't have band gap  distance between and conduction band and valence band  Mean Free Path: The distance are travels between two successive collisions dependent on temperature
Trisulators have higher band gap  Conductors don't have band gap  distance between and conduction band and valence band  Mean Free Path: The distance are - travels  between two successive calisions dependent
Insulators have higher band gap  Conductors don't have band gap  distorce between  conduction band and  valence band  Mean Free Path: The distorce are - travels  between two successive collisions  dependent  on temperature  #include a station.  int main (int arga, char** argv) {  fork();  printf ("chemisty sucks");
Insulators have higher band gap  Conductors don't have band gap  distance between  conduction band and  valence band  Mean Free Path: The distance are - travels  between two successive collisions  dependent  on temperature  # include estdio.h>  int main (int arge, char**argv) {  fork();
Trisulators have higher band gap  Conductors don't have band gap  distorce between  conduction band and  valence band  Mean Free Pata: The distance are - travels  between two soccassive colisions  dependent  on temperature  #include estatio.h>  int main (int argc, char** argv) {  fork();  printf ("chemistry sucks");  veture o;  y  # This code will print the street twice  why?
Insulators have higher band gap  Conductors don't have band gap  distance between  conduction band and  valence band  Mean Free Path: The distance are - travels  between two soccassive calisions  dependent  on temperature  #include a stdio.hz  int main (int argo, char**argy) {  fork();  printf ("chemistry sucks");  suttern o;  y  # This cade will print the stmt twice
Trisulators have higher band gap  Conductors dont have band gap  distance between  conduction band and  valence band  Mean Free Path: The distance are - travels  between two successive collisions  dependent  on temperature  # include a stdio.h>  int main (int arga, char** argv) {  fork();  printf ("chemistry suckes");  veture o;  }  # This code will print the stmt twice  why?  because fork(); (reates a parallel  child process on another tweed  SOLID MATERIALS  some particles kept  //at periodic distances
Trisulators have higher band gap  Conductors don't have band gap  distonce between   conduction band and  Mean Free Path: The distonce are - travels  between two successive collisions dependent on temperature  #include a station.h.>  int main (int argo, char** argv) {  fork();  printf ("chemistry suckes");  uethin o;  }  # This ade will print the start twice why?  because fork(); (reates a parallel child process on another tweed
Insulators have higher band gap  Conductors don't have band gap  distance between  conduction band and  valence band  Mean Free Path: The distance are - travels  between two soccassive collisions  dependent  on temperature  #include a stdio. h.>  int main (int arga, char* argy) {  fork();  printf ("chemisty suckes");  veturn o;  }  # This ade will print the stmt twice  why?  because fork(); (reates a parallel  child process on another tweed  SOLID MATERIALS  GRYSTALLINE (single crystal)  Ly Poly CRYSTALLINE  Ly Amorphous  Ly  Amorphous
Insulators have higher band gap  Conductors don't have band gap  distance between  conduction band and  Valence band  Mean Free Path: The distance are - travels  between two soccassive collisions  dependent  on temperature  # include estdio.hz  int main (int arge, char** argy) {  fork();  printf ("chemistry suckes");  veturn o;  }  # This code will print the start twice  why?  because fork(); (reates a parallel  child process on another tweed  SOLID MATERIALS  GRYSTALLINE (single crystae)  L POLY CRYSTALLINE  L AMORPHOUS  Skuctive
This where higher band gap  Conductors don't have band gap  distore between  Conduction bond and  Valence band  Mean Free Pata: The distance are - travels  between two soccessive calisions  dependent  on temperature  # include cstdio.h>  int main lint arge, char**argy) {  fork();  printf ("chemistry suckes");  Juturn o;  y  # This code will print the start twice  Why?  Lacause fork(); (reades a parallel  Child process on another tweed  SOLID MATERIALS  Same particles kept  ""  Jacause fork()  CRYSTALLINE (Surgle crystal)  GRYSTALLINE (Surgle crystal)  Gromorphous  Strict  Jenorphous  Strict  Strict  Lacause  Lacause  Jenorphous  Jenorphous  Strict  Jenorphous  Strict  Jenorphous  Strict  Jenorphous  Jenor
Trisulators have higher band gap  Conductors don't have band gap  distance between  conduction bond and  valence band  Mean Free Pach: The distance are travels  between two successive collisions  dependent  on temperature  #include estations  int main lint argo, char** argul {  fork();  printf ("chemistry suckes");  return o;  }  # This code will print the struct twice  why?  because fork(); (reates a parallel  Child process on chortus thread  SOLID MATERIALS  some particles responded  CRYSTALLINE (single crystae)  L POLY CRYSTALLINE  L Amorphous  Sincle  from any point,  it behaves the  some  Some  Amorphous to periodicity/ pattern  Structure  Polycrastalline than one type  of crystal
This conductors have higher band gap  Conductors don't have band gap  distance between conduction band and valence band  Plean Free Pace: The distance are framels  between two successive collisions dependent on temperature  #include estation.h>  int main lint argo, char argul {  fork();  printf ("chemisty sucles");  Jethn o;  }  # This code will print the stant twice why?  because fork(); (reades a parallel child process on conduct thread  SOLID MATERIALS  Some particles kupt of prophycrostalline (single crystal) Lypolycrostalline (sin
Tinsulators have higher band gap  Conductors don't have bend gap  distone between  conductions bond and  valence band  Man free Pace: The distone are travels  dependent  on temperature  # include cstdis.h.>  int main (int arge, char argy) {  fork();  printf ("chamisty suckes");  ueturn o;  y  # This code will print the start twice  why?  because fork(); (reates a parallel  child process on another twice)  Why?  because fork(); (reates a parallel  child process on another twice)  Why?  because fork(); (reates a parallel  child process on another twice)  Why?  because fork(); (reates a parallel  child process on another twice)  Why?  because fork(); (reates a parallel  child process on another twice)  Sollo MATERIALS  some porticle rept  //ac periodic distances  L. polysic asstralline  L. pariodic  shock/e  single of crystal  pariodic  pariodic  shock/e  single of crystal  pariodic  processor  pariodicity/ pattern  shucture  Polysic asstralline on periodicity/ pattern  shucture  Polysic asstralline on the type  of crystal  used in gate  was differently  anical on contains differently  caused g nains / domain  by usually looned—loopen  in diamoter
This licens have higher band gap  Conductors don't have bond gap  distorice between conduction bond and valence band  Mean Free Pach: The distorice are - travels between two successive adistions dependent on temperature  # include a stration.  int main (int argo, char " argy) {  fork();  printf ("chemisty suckes");  vetrin o;  }  # This case will print the struct twice why? because fork(); (reades a parallel chold process on another tweed  SOLID MATERIALS  Some particles kept // at periodic distories  GRYSTALLINE (Surgle crystal)  Ly POLY CRYSTALLINE Ly Amorphous  South  Amorphous  Amorphous  Prom any point, It behaves the Some Some  I { o o o  Some Polycrastalline y particles for the Some I { o o o  Some Polycrastalline y particles  Polycrastalline y more than one type of crystal  used in gate  The cont aims differently single form any paint one type of crystal  used in gate  Cont aims differently survented crystals called grains / dormain by usually loonen—laonen
This blactors have higher band gap  Conductors dant have bond gap  distance between  conduction bond and  valence band  Mean Free Peta: The distance are travels  between two soccassive adistans  dependent on temperature  # include estitions  int main (int argo, chart argy) {  fork():  printf ("Chemisty suckes");  veturn o;  }  # This code will print the start twice  why;  because fork(); (reades a parallel  child process on another tweed  Solld MATERIALS  Some particles kept  "as periodic distance  "as periodic distance  GRYSTALLINE (single crystal)  b Poly CRYSTALLINE  GAMORPHOUS  Amorphous > no periodicity / pattern  structure  Polycrastalline = nora than one type  ef crystal  used in gate a  mutaal in  cont ains differently  mutaal in  separated with each  other by grain / demain
Thisulators have higher band gap  Conductors dant have beind gap  distone between and conduction bond and valence band  Mean Free Pash: The distone are travels  between two successive calisions dependent  on temperature  # include astdic.h.>  int main lint argo, chart argy) {  fork();  printf ("chemistry suckes");  Justin o;  }  # This ade will print the struct twice  why;  because frike(); (reates a parallel chield process on another twood  SOLID MATCRIALS  Some particles responding to Polyce STALLINE  J. Amarphous  J. Crystalline (single crystal)  J. Polycestaphiline  J. Amarphous  Shucture  Shucture  Polycenstaphine > no periodicity/ pattern  Shucture  Polycenstaphine > more then one type  of crystal  mos Transistar aniented crystals  called grains / domain  in diameter  J. separated with each  other by grain / domain  bound aries
This block howe higher bend gap  Conductors don't howe bond gap  distone between  Conduction bond and  Valence bond  Much Free Path: The distance are - travels  between two successive calificans  dependent on temperature  # linclude esticions  int main lint arge, char* argul {  fork();  printf ("Chemistry suckes");  Juthin o;  }  # Dhis and will print the street twice  why?  because fork(); (reales a parallel  cheld process on another tweed  SOLID MATERIALS  Some particles kept  "ac periodic distance  by Poly are stalling  Grystalling (single crystal)  Ly Poly are stalling  Grystalling (single crystal)  Grystall on any point,  Ly one periodicity/ pattern  Structure  Polycrystalling > more than one type  of crystal  when your of the one type  of crystal  when your of the one type  of crystal  contains differently  aniented  Used in gate  Ly supported crystals  could grain / domain  by usually loom—leapen  in diameter  Us separated with each  oner by grain / domain  bound gries  Polycrystals with grains that are clone  in diameter are called nanopoly crystalline.
This Lacron's hove higher bond gap  Conductions bond have bond gap  distance between a conduction bond and valence band  Mean free Pala: The distance are travels between two successive collisions on temperature on temperature international continuous fore();  printf ("chemistry success");  uttina o;  fore();  printf ("chemistry success");  uttina o;  fore();  printf ("chemistry success");  uttina o;  child process on another tweed  SOLID MATERIALS some porticles texpt map periodic distance (held process on another tweed  SOLID MATERIALS some porticles texpt map periodic distance (strople crystal).  L. POLY CRUSTALLINE (strople crystal).  J. J. L.
This black have higher band gap  Conductions have higher band gap  distance between  Conduction bond and  National band and  National band are travels  between two soccasive accisions  dependent  On temperature  #include astdichs  int main lint argo, chart argul {  fork() printf ("Chemistry suckes");  Justin of,  Printf ("Chemistry suckes");  Justin of,  CRYSTALLINE (striple crystal)  L POLY CRYSTALLINE  L POLY CRYSTALLINE  J Poly CRYSTALLINE  L POLY CRYSTALLINE  J POLY CRYSTALLINE  Amorphous To periodicity/ pattern  Structural  Poly CRASTALLINE > more than one type  of crystal  I same for crystal  Mos Transister and called growns / domain  by suckly loan - loopen  in diameter  L separated with each  other by grain / domain  bound aries  Polycrystals with grains that are alone  in diameter are called annopaly crystallize  if we dope polycrystalline structure  if behaves as exide (insulatory)  ##Remember: for p type we have  pinvalent impurities for doping  were Silicon eg: Boran
This later have higher band gap  Conductors don't howe bould gap  distorus between  conduction bond and  Valence band  Mean free fact: The distance are travels  between two successive colisions  dependent  on temperature  # include a station how  int main (int argo, chart agou) {  fork();  printf ("chemistry sucles");  utettin o;  }  # Dhis and will print the struct twice  who;  because fork(); (reactes a parallel  child process on another thread  SOLID MATCRIALS  GRYSTALLINE (Surple cristal)  L POLYCROSTALLINE  L Amorphous  GRYSTALLINE (Surple cristal)  L POLYCROSTALLINE  STORE  Amorphous - no periodicity/ pattern  Structure  Polycrostal the behaves the  L Sone  L Sone  Amorphous - no periodicity/ pattern  Structure  Polycrostal the behaves the  L Sone parios / domain  y usual in cont ains differents  anisothed crystals  could a gracies / domain  by usual to come logue  L separated with each  other by grain / domain  boundaries  Polycrystals with growns that are clone  in diemacer and called nanopaly crystallice  if we dope polycrystalline structure  it behaves as axide (insulation)  ## Remember: for p type we have  pinalent impunities for doping  were Silicon  eg: Boren  for n type, we have pertavalunt  impunities for doping wort silicon.  eg: Prosphorus
This black have higher band gap  Conductions have higher band gap  distance between  Conduction bond and  National band and  National band are travels  between two soccasive accisions  dependent  On temperature  #include astdichs  int main lint argo, chart argul {  fork() printf ("Chemistry suckes");  Justin of,  Printf ("Chemistry suckes");  Justin of,  CRYSTALLINE (striple crystal)  L POLY CRYSTALLINE  L POLY CRYSTALLINE  J Poly CRYSTALLINE  L POLY CRYSTALLINE  J POLY CRYSTALLINE  Amorphous To periodicity/ pattern  Structural  Poly CRASTALLINE > more than one type  of crystal  I same for crystal  Mos Transister and called growns / domain  by suckly loan - loopen  in diameter  L separated with each  other by grain / domain  bound aries  Polycrystals with grains that are alone  in diameter are called annopaly crystallize  if we dope polycrystalline structure  if behaves as exide (insulatory)  ##Remember: for p type we have  pinvalent impurities for doping  were Silicon eg: Boran
Tirsulators have higher band gap  Conductors don't have bond gap  Conductors don't have bond gap  distore between  Conduction bond and  Valence band  Then Free Pace: The distore are travels  between two successive cultivans on temperature  # (ordide estice to  int main (int argo, chart argu) {  fork();  printf ("Chemostry sucles");  Jeans forkel; (reaces a parallel  Child precase of chollul tweed  SOLID MATCRIALS  Sone paradoc distore  "Ma paradoc distore  "A problem Filling (surgle crystae)  L poils cristification  L poils cristification  L poils cristification  Shockers  Amberphous > no pariodicity/ pattern  Structure  Polls cristification  Shockers  And gate  I for cristian  Mos Transister  Justelly loans—laque  L separated crystaes  Shockers  Shockers  Shockers  And gate  I was disperated crystaes  Shockers
This literary have higher band gap  Conductors don't have bond gap  distance between  Conductors don't have bond gap  distance band  Phen Free Face: The distance are travels  between two soccessive adistance on temperature  the hadde costdon's  int main line arge, charter argul [  fork();  prints ("anomosty suches");  Jeacouse friek(); creates a parquel child process on another tweed  Sollo MATERIALS  Grystalline (surgle creates)  Grystalline (surgle c