

Mechanical behavior of materials

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Dislocation Edge and Screw



Mechanical Behavior of Materials (Hindi)

Dislocations: Edge and Screw

Namaskar main swagat karta hoon aapka is course mein jiska naam Mechanical Behavior of Material hai jisko hum Hindi mein padhenge. Toh last part mein humne dekha ki jo theoretical shear strength hai material ka wo bahut zyada hota hai, kitna zyada hota hai, 10 to the power 2 to 10 to the power 4 orders zyada hota hai kisse, experimentally observed value se. Toh humne ek concept dekha tha dislocations ka, humne bola tha ki kuch local bonds broken hote hain material mein ya material mein already defects hote hain. Toh usi defects ko humne dislocations ka naam diya tha. Toh is part mein janenge ye dislocation hote kya hain.

Toh sabse pehle dekhte hain last part mein humne jahan par chhoda tha. Toh yahan par maine dikhaya tha ki ek defected crystal hai, aap dekhenge ki yahan par locally bonds already broken hain aur humne dekha tha ki agar isko shear displace karte hain ya is tarah se agar hum isko shear deformation denge toh ye jo wahan par slip hogi aur slip hone ke baad ek step taiyar hoga surface par ye humne dekha tha last part mein. Toh ye jo displacement hai ya ye jo step jo bahar aakar bani hai isko hum kehte hain displacement vector aur agar hum isko dislocation ki bhasha mein janenge toh isko hum kehte hain Burgers vector. Toh ye ho gaya mera Burgers vector. Ye jo

displacement vector hai ye kya quantify kar raha hai? Ye mere material ke plastic deformation ko quantify kar raha hai ya slip jo phenomena hai usko quantify kar raha hai uska ye measure hai Burgers vector jo deformation ka measure jo hai ye hai Burgers vector. Isko main abhi is displacement vector ko Burgers vector ke naam se denote kar raha hoon.

Toh aap dekhenge ki ye jo main jab shear deformation diya tha toh ye crystal yahan se yahan tak move hua tha aur ye jo step taiyar hua tha ye hai mera displacement vector ya Burgers vector. Isko hum yaad rakhenge kyunki yahi ek parameter hai jisse hum dislocations ko ka definition ya vyakhya karenge.

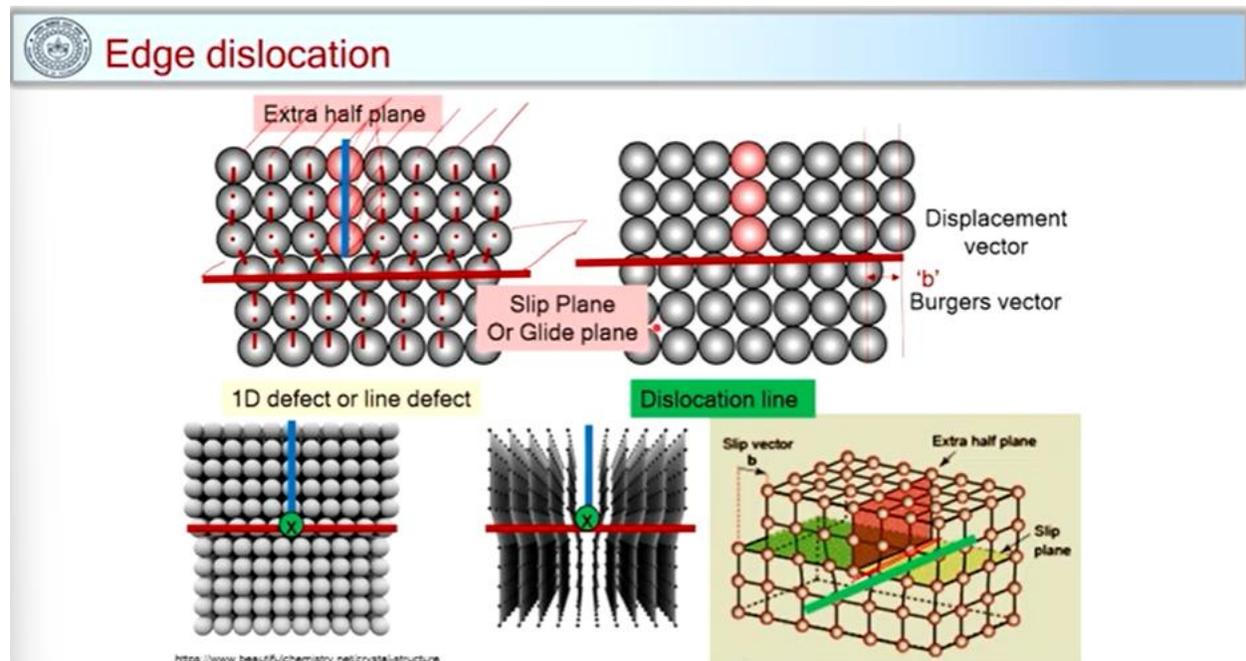
Abhi hum dekhte hain jab main ye defected crystal taiyar kiya tha maine bola tha ki yahan par bonds broken hain locally broken hain. Toh dekhte hain ki agar main planes agar draw kar raha hoon toh aap dekhenge ki yahan par yahan par jo local bonds hain yahan par zyada broken hain aur hum ek cheez aur dekh sakte hain ki agar ye maine red plane deliberately yaani jaanbujh ke mark kiya hai is tarah se is color mein aap dekhenge yahan par mera points bahut zyada broken hain aur ye jo plane hai agar aap dekhenge ki agar main ek planes count karoon 1 2 3 4 5 6 7 ye seven planes upar hain aur yahan par dekhenge neeche mein 1 2 3 4 5 6 7 se seven planes hain. Toh ye extra plane yahan pe maine insert kiya hai ye jo plane mark kiya hai ye extra plane hai. Toh aap isko samajhiye kyunki ye main 2D mein dikha raha hoon agar aap 3D mein dekhenge toh ye planes is tarah se is direction mein honge. Toh ye mera extra plane yahan pe inserted hai ye jo plane hai is tarah se inserted rahega aur ye jo extra plane hai ye jo extra plane hai isko extra half plane kehte hain yaani kyunki ye aadha plane inserted hai aur aadha plane yahan se missing hai. Main do cheez keh sakta hoon ya toh ek aadha plane inserted hai upar mein ya aadha plane missing hai neeche se. Toh ye extra half plane kehte hain dislocation ki bhasha mein.

Agar hum isko dekhenge extra half plane ko solid models ki tarah dekhte hain. Toh agar aap dekhenge toh extra half plane yahan par kahan pe ye mera extra half plane hai. Toh isko mark kar lete yahan par ek extra half plane mark kar lete aur ye jo plane hai aap acche se dekh sakenge ye jo plane tha ye mera extra half plane tha. Main do cheez keh sakta hoon jab main defect taiyar kar raha hoon material mein agar defect material hai mera toh wahan par main dekhoonga ki toh main extra half plane add kar raha hoon ya extra half plane remove kar raha hoon. Agar main dekhoonga idhar mein 2D mein toh yahan se agar main extra half plane remove karunga toh mere paas extra half plane add ho jayega upar mein aur ye mere dislocation ko ya defect ko taiyar karega material ke andar yaani material mein ek defect taiyar karega.

Abhi dekhte hain kuch aur cheez jahan par maine dekha tha ki agar ye dislocation aise move hota hai left to right agar move ho raha hai toh ye ek particular plane pe move hota hai. Ye agar hum dekhenge ye bhi hum 3D mein janenge toh ek particular plane hoga ye toh 2D mein hum dekh rahe hain par ye dekhenge toh ek aise ek plane hoga. Toh ye plane pe ye upar wala jo crystal ka part hai ye move ho raha hai neeche wale crystal ke part ke upar. Toh ye jo plane hai ya ye plane hai yahan pe hum dekhenge ye plane agar main dekhoonga toh step is plane ke upar taiyar hui hai. Toh ye jo plane hai ya ye plane hai isko main kehta hoon slip plane aur glide plane. Slip plane aur glide plane isliye keh raha hoon kyunki yahan par upar wala jo hissa hai crystal ka wo slip ho raha hai ya phisal raha hai neeche wale crystal ke upar se. Toh isko hum kehte hain slip ya glide plane yahan pe mark kar lete hain ye slip plane aur glide plane. Toh aap dekhenge ye jo plane hai yahan pe aur ye jo plane yahan pe hai iske upar ye half plane glide karega ya phisalga isliye isko hum kehte hain slip aur glide. Glide ka matlab bhi hota hai phisalna kisi plane ke upar phisalna isko isko bhi glide kehte hain.

Toh abhi hum aur ek cheez janenge yahan par agar main dekhoonga yahan par toh main ek cheez keh sakta hoon yahan par row of atoms missing hai ya yahan par main dekhoonga ki ek row of atoms missing hai phir isko hum acche se dekhenge is is point par agar hum dekhenge toh ek row of atom missing hai isko kehte hain hum dislocation line. Abhi isko thoda aur samjhenge schematic ke baare mein. Toh ye mera crystal hai aur isme maine ek extra half plane insert kiya jisko laal color se mark kiya aur slip plane kaun sa yahan pe yahan pe green aur blue green aur yellow mein mark kiya maine ye slip plane mark kiya hai aur yahan par displacement vector aur slip vector ya Burgers vector isko main b se denote kar raha hoon ye mera Burgers vector ho gaya yahan par agar hum dekhenge toh is tarah se kuch is tarah se aap dekhenge ye extra half plane ke just neeche main keh sakta hoon ki row of atoms missing hai ya yahan par zyada bonds broken hain yahan par is part par ye green maine mark kiya yahan par. Aap yahan par samjhein ki ye jo line hai ye jo line hai ye jo move ho rahi hai slip plane par main keh sakta hoon ye jo atomic lines hain ye move ho rahi hai aur is line ko hi main kehta hoon dislocation line. Toh ye jo line hai ye line jab hum baat karenge toh 1D defect hai ya one dimensional defect hai aur isko hum line defect kehte hain.

Toh hamare paas teen terminology ho gayi hai yahan par ek Burgers vector, ek extra half plane aur ek dislocation line. Toh ye teen cheez hain jo kisi bhi dislocation ko hum define karne ke liye istemaal karte hain. Is case mein aap dekhenge ki jo ye dislocation line hai aur ye Burgers vector hai iska ek relation hai aur iske wajah se hi isko hum edge dislocation kehte hain. Abhi uske baare mein aur jante hain next slide mein.

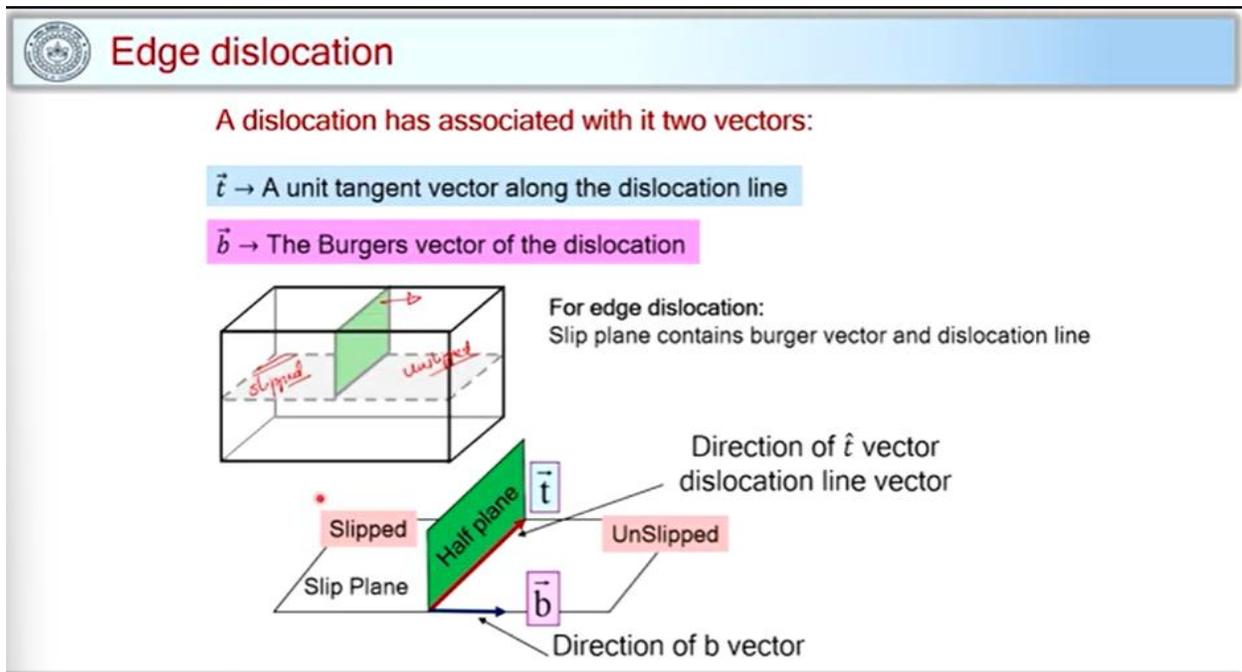


Toh agar jab main edge dislocation ki baat kar raha hoon toh wahan pe mujhe do cheezein chahiye edge dislocation ko define karne ke liye ek hai mera tangent vector. Ye jo tangent vector hai isko main is tarah se denote kar raha hoon ye hai vector along dislocation line yaani dislocation line ke along jo hoga isko main tangent vector kahoonga aur ye jo b hai isko main Burgers vector se janta hoon aur ye jo slip plane hai ye slip plane mera dono ko yaani jo Burgers vector hai ya dislocation line vector hai ye mere slip plane par hone chahiye. Yahan par slip plane kahan par hai ye jo shaded region hai grey mein ye mera slip plane hai. Toh ye jo shaded region hai ye maine slip plane ki

tarah mark kiya yahan par ye jo hai mera slip plane hai ye mera slip plane hai aur ye jo green mark kiya hai ye hai mera extra half plane. Toh hum kahenge ki yahan par extra plane above hai ye aur neeche se jo extra plane hai wo missing hai dono tarah se hum karenge toh hum hum dekhenge ki material mein hum defect taiyar kar rahe hain.

Toh dislocation ye jo ho gaya mera half plane aur tangent vector hum dekhenge toh ye mera tangent vector ho gaya ye jo line hai ye line jo vector yahan par hum bolenge ki ye mera tangent vector hai aap dekhenge ki tangent vector is slip plane par hi lie karta hai ya slip plane par hi rehta hai. Agar hum ye ho gaya mera dislocation tangent vector isko maine is tarah se mark kiya aur ye ho gaya mera Burgers vector kyunki humne dekha tha ki Burgers vector kya hota hai ye plastic deformation ka measure hai aur ye displacement vector hai. Toh displacement humne dekha tha ki is direction mein ho raha tha toh ye hai mera Burgers vector aur ye hai mera direction of Burgers vector. Toh aap dekhenge ki dono vector Burgers vector aur tangent vector ye dono vector mere slip plane mein rehte hain aur agar aap dekhenge ki tangent vector aur Burgers vector ek dusre se perpendicular hain.

Abhi hum aur jate hain aur edge dislocation ke baare mein aur jankari lete hain. Toh agar jab mera ye dislocation line vector move ho raha hai toh mere paas do region taiyar honge ek slipped region hoga aur ek unslipped region hoga yaani agar aap dekhenge ki is tarah se movement ho raha hai toh ye mera part slip ho jayega yaani phisal gaya tha but ye unslipped hai is tarah se. Toh main ek aur cheez important cheez batana chahta hoon ye jo dislocation line vector hai ya tangent vector hai ye mera do crystal ko do hisse mein divide karta hai ya baant-ta hai ek slipped part mein aur ek unslipped part mein.



Abhi hum jante hain ki edge dislocation ke baare mein abhi hum yahan par dekhenge ki yahan par ek extra half plane hai aur agar main shear stress yahan par apply kar raha hoon toh ye dislocation hai mera yahan se is side se is side move hoga. Toh isko mark kar lete kuch ek middle configuration mark kar lete is dislocation ke movement ki ye mera extra half plane hai ye humne dekha tha. Toh

abhi hum dekhenge ki ye movement kaise ho rahi hai abhi aap dekhenge ki ye dislocation is tarah se move ho raha hai yahan se left to right ye move ho raha hai aur aap dekhenge ki yahan par locally jo hai wo bonds bandh rahe hain aur toot rahe hain yaani making aur breaking of bonds ye jo ho raha hai wo locally ho raha hai aap dekhenge ki yahan par main yahan par hoon toh yahan par bond bane toote yahan par bane toote aur yahan par bane toote aur ye dekhenge ki yahan pe end mein jaake displacement vector taiyar hoga usko main Burgers vector ka naam de raha hoon.

Toh hum dekhenge ki ye mera ek extra half plane hai theek hai ye mera extra half plane hai aur ye ho gayi meri dislocation yaani ye mera ho gaya dislocation jo move ho raha hai is plane par move ho raha hai isko maine slip plane ke naam ki tarah jana tha. Ye jo plane hai isko main kahoonga slip plane aur ye jo thi maine bataya tha ki yahan par main agar main baat karunga yahan par row of atom ya line jo baat karunga ye mera ho gaya dislocation line aur dislocation ko hi hum represent karenge tangent vector se. Toh iska schematic dekhte hain ek baar ye mera slip plane ho gaya aur slip plane mein main dislocation line vector abhi plot kar raha hoon toh ye ho gayi meri dislocation line vector t is tarah se kuch maine mark kiya yahan par hum dekhenge ki hamari taraf aa raha hai ya andar ki taraf ja raha hai yaani plane ko perpendicular hai hamari taraf ya andar ki taraf. Toh ye jo dislocation tangent vector hai isko main yahan pe mark kiya aur ab hum dekhenge ki ye jo Burgers vector hai ya jab dislocation move hoga toh hum dekhenge ki dislocation move hone ke baad ye jo Burgers vector hai ye perpendicular hai mere tangent vector ki taraf. Agar aap dekhenge agar main isko phir se play karoon toh aap dekhenge ki ye jo dislocation vector hai yaani Burgers vector hai yahan par aap dekhenge main abhi yahan par mark kar raha hoon ye jo Burgers vector hai yahan par create hua hai ye mere tangent vector ko perpendicular isko mark kar lete hain yahan par ye jo mera Burgers vector is direction mein hai aur tangent vector maine bola tha ki perpendicular hai is plane ko toh tangent vector kuch is tarah se jayega toh hum dekhenge ki yahan par tangent vector jo hai ya Burgers vector jo hai ek dusre ko perpendicular hai.

Toh ye mera definition hai edge dislocation ka toh edge dislocation ko agar aap poochenge koi agar aapko pooche toh aapko batana hai ki edge dislocation mein mera Burgers vector perpendicular rehta hai tangent vector ko dono ek dusre ko perpendicular rehte hain aur ek cheez aur dhyaan mein rakhni hai ki dono vector ek hi plane mein rehte slip plane mein. Toh isko hi main edge dislocation kehta hoon toh ye hai mera Burgers vector jo main define kiya hoon ki ye tangent vector ko hamesha perpendicular rahega edge nature mein isko main kehta hoon pure edge dislocation. Aur maine bataya tha ki ye jo dislocation line vector hai yahan pe ye differentiate karta hai ya baant-ta hai slipped part ko unslipped part ko toh main jab dislocation yahan se is taraf move ho raha hai toh mera slip badh raha hai yaani mera crystal ek dusre ke upar phisal raha hai toh isliye dislocation line hamesha differentiate karti hai slipped aur unslipped part ko ye ho gaya mera slipped part ye mera unslipped part hoga agar dislocation yahan se yahan hoga toh slipped part badhega yahan pe.

Toh aur aur kuch cheez aap dekh sakte hain ki dislocation jab move hota hai toh direction of dislocation movement is perpendicular to the dislocation line. Toh agar mera yaani agar aap dekhenge extra half plane yahan par move ho raha hai yaani mera dislocation move ho raha hai toh aap dekhenge ki ye jo line hai ye iska movement kaise ho raha hai iska movement is tarah se ho raha hai ki ye jo movement hai perpendicular to dislocation line yaani mera tangent vector is tarah se toh mera movement is tarah se hoga is direction mein isko bhi mark kar lete hain agar mera movement is tarah se ho raha hai toh ye hum dekhenge ki ye jo movement hai dislocation line ka ye mera tangent vector ko perpendicular hai. Doosri cheez the direction of dislocation movement is in the direction of stress hum dekhenge ki maine stress is tarah se apply kiya tha aap

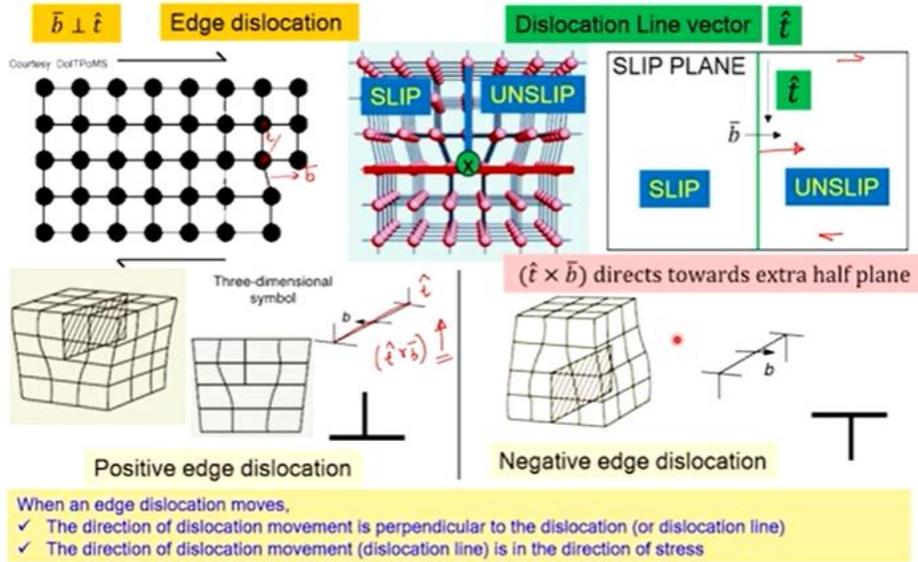
dekhenge maine is tarah se stress apply kiya hai aur ye jo movement hai along the direction of stress hai ye direction is tarah se agar main yahan par bhi mark karta hoon slip plane pe agar main shear stress mark kar raha hoon toh ye jo movement hai along the direction of shear stress aur stress.

Agar hum dekhenge jo extra half plane ki abhi baat karte toh mere paas do scenario ho sakte hain agar extra half plane maine slip plane ke upar daal diya yaani jo mera slip plane hai ye iske upar hai toh ek scenario ho gaya doosra scenario is tarah se bhi ho sakta hai ki mere slip plane ke neeche ho sakta hai toh ye do configuration ho sakte hain main defect taiyar kar sakta hoon material ke andar. Toh ye jo scenario hai jahan pe extra half plane above hai isko teen three dimensional symbol mein hum is tarah se represent karenge is tarah se kuch ulta T banayenge un dono ko jodenge ye jo hogi mere dislocation line represent kar rahi hai ye jo hai mere dislocation line ya tangent vector ko represent kar rahi hai aur ye jo hai mera Burgers vector hai jo perpendicular hai. Toh three dimensional symbol mein hum kuch is tarah se represent karte hain edge dislocation ko yahan par hum dekhenge ki Burgers vector perpendicular hai mera tangent vector ko aur agar hum 2D mein dekhenge agar iska agar saamne se is face ko dekhenge toh mujhe kuch is tarah se dikhayi dega toh ye jo hai ye mera extra half plane hai aur ye mera slip plane hai toh main edge dislocation ko yahan par is tarah se represent kar raha hoon yahan par extra half plane above hai aur ye jo hai mera slip plane hai toh ye jo hai inverted T ki tarah dekh aur agar isko main represent karunga toh yahan par dekhoonga ki main ye jo hai extra plane bottom mein hai ye mera slip plane hai ye tangent vector aur ye mera Burgers vector hai toh aap dekhenge tangent vector perpendicular hai aur extra plane bottom mein hai toh isko main kehta hoon is configuration kahoonga jahan par extra half plane above hai slip plane ke isko main kehta hoon positive edge dislocation aur ye jo configuration hai isko main kehta hoon negative edge dislocation aur usko main ye T ki tarah represent karta ho toh ye ho gaya mera negative edge dislocation.

Abhi mathematically isko is tarah se jaan sakte hain main humne dekha tha ki edge dislocation mein ye b aur t perpendicular hai agar main t cross b leta hoon toh agar ye jo direction hai iska cross product ka direction jo hai wo agar extra half plane ke upar aur extra half plane ki taraf jata hai toh main usko positive edge dislocation kahoonga. Isko is tarah se samajhiye agar main t cross b loonga yahan pe toh is mujhe ek vector milega aur wo vector agar above yaani slip plane ke is direction mein dikha raha hai toh ye jo hoga mera positive edge dislocation agar wo product ki direction neeche hai toh main kahoonga ki extra half plane neeche hai aur ye mera ho jayega negative edge dislocation. Toh agar aap t cross b karke dekhenge aur uska dekhenge ki magnitude kis side aa raha hai toh wahan se aapko pata chalega ki extra half plane above hai ya below hai aur us tarah se hum mathematically bol sakenge ki mera positive edge dislocation ya negative edge dislocation.



Edge dislocation ($\vec{b} \perp \hat{t}$)



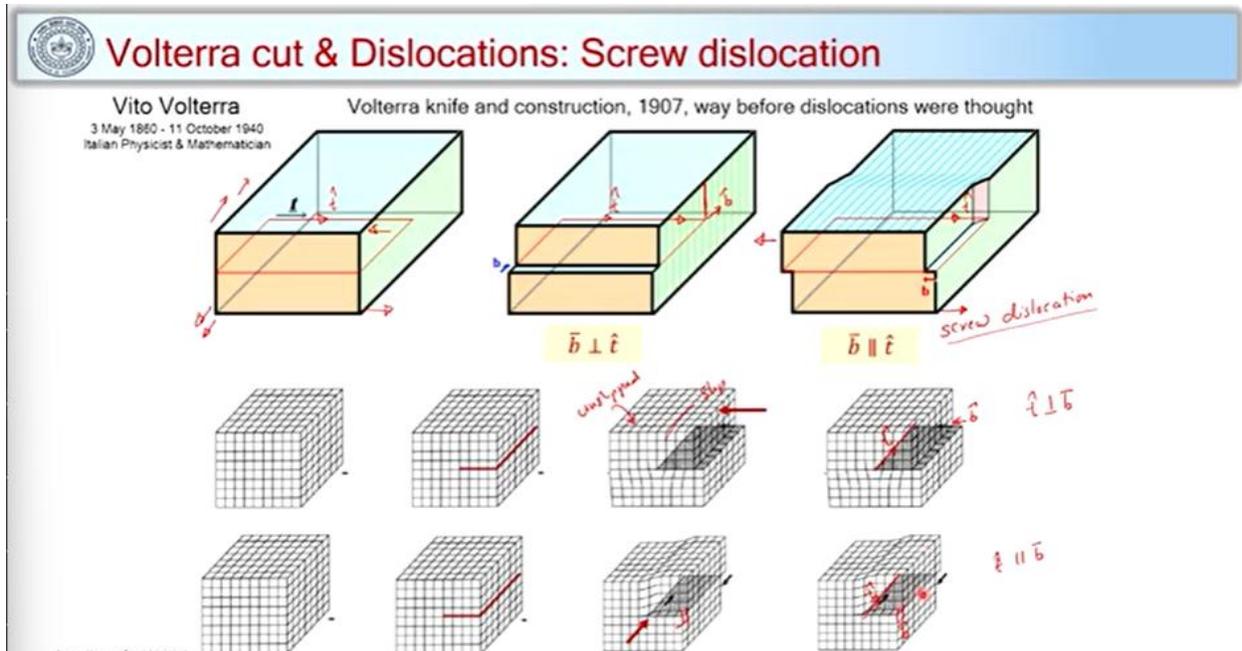
Abhi hum aage badhte hain aur dekhte hain Volterra cut aur dislocations ke baare mein jante hain. Toh ye jo Volterra cut hai ya dislocation aane se bahut pehle Vito Volterra ne continuum mechanics mein material mein defect taiyar karne ke liye ek method di thi. Toh Vito Volterra ne kya kiya tha agar mere paas ek Volterra knife hai aur main kuch construction karunga ye 1907 mein unhone diya tha before yaani humne dekha tha ki dislocation around 1940 mein thought kiye the yaani soche gaye the par 1907 mein hi Vito Volterra ne ek continuum mechanics mein aur continuum solids mein defects taiyar karne ke liye ek methodology di thi. Toh dekhte hain uske baare mein toh ye mere paas ek solid hai abhi main kya kar raha hoon mera ek paas Volterra knife hai aur soch ke dekhiye ki main plane cut kar raha hoon yahan se jo red color plane hai jo mark kiya hai ye maine cut kar diya yahan se aur nikal diya is plane ko is material se. Toh abhi kya ho gaya ye jo material hai ya upar aur neeche wala isko main kisi ek direction mein move kar sakta hoon kyunki mere paas ek flexibility aa gayi hai is cut ke wajah se aur ab dekhenge ye ek tangent vector mark kiya hai ye deliberately is tarah se mark kiya hai ye mera tangent vector hai is tarah se. Toh ye isliye mark kiya hai kyunki hum dislocation ki jab baat karenge toh humein aasani ho samajhne mein toh isliye main tangent vector yahan pe mark kar raha hoon.

Abhi main is solid ko kuch is tarah se deform kar sakta hoon yaani aap samajhiye main is solid ko upar se is tarah se agar main shear stress apply karunga toh ye upar wala solid is tarah se move hoga aur neeche wala solid is tarah se move hoga ya main left to right usko move kar sakta hoon agar main shear stress yahan se aise apply kar raha hoon aur aur idhar se is tarah se apply karunga toh ek shearing taiyar hogi is crystal mein ya deformation taiyar hoga is crystal mein. Toh jante hain isko kis tarah se hum istemaal kar sakte hain. Toh maan lete hain maine pehle is tarah se deform kiya aap dekhenge ki maine ye stress apply kiye toh aap dekhenge ye upar wala part us tarah peechhe mein dhakela gaya hai yaani slip hua hai aur neeche wala part aage aa gaya toh iske wajah se aap dekhenge jo maine tangent vector mark ki thi yahan pe yahan par material mein kuch displacement honge kuch displacement honge aur ye jo Burgers vector yahan par hai aap dekhenge ki jo Burgers vector ya deformation jo taiyar hui ye dekhenge aap ye perpendicular hai mera tangent vector ko yahan par. Toh ye jo deformation maine taiyar ki hai yahan par humne dekha

tha ki ye edge dislocation ka definition hai agar tangent vector perpendicular hai mere Burgers vector ko toh isko hum edge dislocation kahenge aur yahan par abhi aap dekh sakte agar side mein aap dekhenge toh ye ye jo ek extra plane yahan par dikh raha hai ye extra half plane hai aur aap dekhenge ye hogi meri dislocation line aur ye ho gaya mera Burgers vector yahan par dislocation line yahan par ja rahi hai andar ya bahar aa rahi hai ye mera ho gaya extra half plane. Toh aap dekh sakte hain Volterra cut se aap ek defect taiyar kar sakte ho.

Abhi agar main is tarah se kuch defect taiyar kar raha hoon toh yahan par maine dekha b main perpendicular kar sakta hoon tangent vector ke saath toh main b parallel bhi kar sakta hoon. Toh b parallel kab karenge agar main shear karunga is direction mein agar main is crystal ko is tarah se deform kiya yaani main isko upar wale ko is tarah se dhakela neeche ko is tarah se dhakela toh mere paas ek shear mil jayega yaani ye ho gaya mera deformation vector jo displacement vector hai isko main Burgers vector kahoonga aur tangent vector yahan pe kahan pe yahi mera tangent vector hai agar is tarah se kahoonga ya toh main keh sakta hoon ki tangent vector yahan pe parallel hai mere Burgers vector se toh main keh sakta hoon ki b is parallel to tangent vector aur yahi is is jo defect ko kahenge is defect ko kehte hain hum screw dislocation jahan pe mera Burgers vector parallel hai tangent vector ke hisaab se isko main likh deta hoon ye jo ye jo defect maine taiyar ki yahan pe isko main kahoonga screw dislocation iske baare mein aur janenge hum par ye concept apko samjhaane ke liye maine is Volterra cut ka istemaal kiya.

Agar hum is tarah se dekhenge ye mere paas ek solid hai aur is solid mein hum ek Volterra cut taiyar karta hoon is tarah se maine kuch plane cut kar diya abhi main isko shear kar sakta hoon kisi bhi direction mein yaani above aur below plane below crystal ko aur maine upar ke crystal ko is tarah se push kiya toh aapko aap dekhenge yahan pe kuch displacement taiyar hua aur ye mera tangent vector yahan par ye jo ja raha hai ye jo mera tangent vector hai toh ye mera tangent vector hai aur yahan par aap dekhenge isko mark kar lete hain ye mera Burgers vector hai aur ye mera tangent vector hai toh aap dekhenge yahan par tangent vector perpendicular hai mere Burgers vector ko aur ye jo part hai pehla wala ye mera slipped part hai aur doosra jo part hai ye unslipped part hai jab main deform karne ki koshish karunga jaise jaise dislocation line is tarah se move hogi main dekhoonga ki mera slip badh raha hai material mein aur crystal mein. Usi tarah se main screw dislocation ko is tarah se samajh sakta hoon yahan par maine cut kar diya mere paas crystal tha maine cut kiya ab maine shear kiya upar wale part ko neeche wale part se toh mujhe is tarah se milega ki ye jo hai ye displacement yahan par milega mujhe ye jo displacement yahan par mil raha hai yahan par mil raha hai yahi mera Burgers vector hai aur hum dekhenge ki ye mera tangent vector tha toh yahan par tangent vector mujhe parallel milega Burgers vector ke saath toh ye hai mera screw dislocation.



3d

Aaiye jante hain screw dislocation ke baare mein aur. Toh screw dislocation mein dekha tha ki Burgers vector parallel hai tangent vector ke tangent vector se. Toh agar mere paas ek aisa kuch crystal hai aur ye ho gayi meri dislocation line jo andar se ja rahi hai crystal ke andar aur maine upar wala crystal shear kiya hai aur ye hai mera displacement jo hai main Burgers vectors ke baare mein janta hoon ye agar yahan par aap clear dekh payenge agar mera upar wala crystal yahan pe toh ye mera Burgers vector ho gaya ab dekhenge ki ye jo Burgers vector hai ye hai parallel to dislocation line definition hai hamare screw dislocation ki.

Abhi hum janenge hard sphere model agar hum dekhenge yahan par ye saare planes is tarah se stacks hain aur aap dekhenge ki agar main is tarah se kuch dekhoon yahan pe agar main is plane ko dekhoon upar wale plane ko hi toh main is tarah se kuch ja raha hoon toh yahan pe koi defect nahi hai par agar main kuch is tarah se displacement karoon agar main is tarah se move ho raha hoon theek hai aur main kuch South West East North is tarah se move kiya aur yahan par aaya ya yahan se shuruat ki toh main dekhoonga ki yahan par displacement taiyar hua yaani aap dekhenge ki maine neech wale plane se chalu kiya tha maine rotate kiya yaani maine apni direction change ki aur upar aa gaya maine upar wale plane par pahunch gaya yahan par jo displacement hai yahi mera displacement vector ho gaya agar wo simple crystal rehta toh main dekhta ki yahan par koi screw dislocation nahi rehta theek hai. Toh ye jo hai main screw ki tarah move hua aur mujhe ek displacement mil gaya isliye hum isko screw dislocation kehte hain.

Agar hum yahan par dekhenge main is tarah se explain karunga agar ye surface dekhenge hum upar wala agar maan lete hain main yahan se shuruat karunga main char unit aa gaya hai ek do teen char yahan se main aaunga ek do teen char aur phir yahan se aaunga ek do teen char aur main yahan se aaunga toh main shuruat kiya wahan se hi pahunch gaya toh is surface mein mera koi defect nahi hai is surface pe par agar main is tarah se kuch dekhoon ye agar defect yahan par maine create kiya hai agar is tarah se kuch dekhoonga main toh main maan lete hain maine yahan se shuruat ki ek do aur main yahan par gaya ek do teen char phir main yahan par aaya ek do teen char aur yahan pe aaya 1 2 3 4 wapas aur main phir se ek do yahan pe gaya toh main dekhoonga ki ye

displacement yahan pe taiyar ho gayi is tarah se aur ye jo displacement taiyar ho gayi main kyunki ek screw ki tarah move hua maine rotate kiya toh isliye main ek deformation vector ki tarah main wahan pe pahunch gaya aur isi nature ko kehte hain isi defect ko hum kehte hain screw dislocation. Agar ye perfect rehta hai toh hum jahan se shuruat ki thi wahan par pahunchne chahiye the par yahan par waisa nahi ho raha hai toh isko hum kehte hain screw dislocation.

Toh iske baare mein aur jante hain toh ye jo ho gayi ye jo line yahan par hum dekh rahe hain ye solid line hai aur ye andar ja rahi hai crystal ke andar se aur bahar nikal rahi isko main dislocation line kahoonga ye mere tangent vector honge wo yahan par bhi aap dekh sakte hain agar main is tarah se move ho raha hoon toh ye jo solid line hai yahan se andar ja rahi hai aur crystal ke andar se nikal rahi hai isliye main isko shaded mein nikala hoon aur ye jo line hai ye dislocation line hai meri. Abhi phir se ek exercise karte hain main is point se chalu ho raha hoon main yahan par move hua phir main kuch aise is tarah se move hua phir is tarah se aaya phir is tarah se aaya phir is tarah se aaya hum dekhenge ki maine jahan par shuruat ki thi uske upar aa gaya hoon ye jo displacement hai ye upar hai aur ye displacement jo hai parallel hai dislocation line se yahi meri definition hai screw location ki.

Toh iska ek schematic bana lete hain ye mera slip plane hai aur is slip plane mein mera tangent vector hai toh ye mera tangent vector hai aur maine draw kiya hai ye jo Burgers vector hai ye mera parallel hai tangent vector se ye mera screw dislocation ka definition hai toh aap dekhenge ki ye mera unslipped part hai ye mera slipped part hai aap dekhenge ki yahan pe agar main isko aur shear karunga agar main is tarah se kuch laga toh ye jo dislocation line hai wo is tarah se move hogi toh aap dekhenge ki ye dislocation line jo hai wo hamesha bifurcate karti hai ya distinguish karti hai mere slipped aur unslipped part ko.

Abhi iska representation dekhte hain ki hum screw dislocation ko kaise represent karte hain. Toh humne dekha tha ki mere paas positive edge dislocation hai negative edge dislocation hai usi tarah se mere paas do type ke dislocations ho sakte hain screw mein bhi right hand screw aur left hand screw. Right hand screw yaani ye hoga main 2D mein agar isko represent karunga toh agar main clockwise move kar raha hoon toh ya right hand screw ki tarah move kar raha hoon toh mera displacement upar aana chahiye aur yahi mera symbol ho gaya right hand screw ka aur left hand screw mein main agar is tarah se rotate kar raha hoon toh mera displacement neeche jayega toh ye ho gaya mera left hand screw.

Abhi hum isko mathematically kaise represent karte is tarah se dekhenge right hand screw mein hum dekhenge ki mera main b aur t ko kyunki dono parallel hai toh agar main unka dot product leta hoon toh mere paas b aana chahiye kyunki tangent vector toh unit vector hai toh ye agar positive hai toh isko main kahoonga right hand screw agar ye negative hai toh main isko kahoonga left hand screw yaani dot product agar negative aa raha hai yaani magnitude aa raha Burgers vector ka negative toh ye mera left hand screw hoga toh aapko hamesha $b \cdot t$ karke dekhna hai mathematically ki mera screw dislocation kya hai. Isko main 3D mein kuch is tarah se bhi represent kar sakta hoon ek dollar symbol maine draw kiya hai yahan par ye dikhata hai ki mere atom ke jo arrangements hai wo screw nature ke hai around dislocation line ye mere dislocation line ho gayi isko main tangent vector ki tarah mark karunga ye meri tangent vector ho gayi aur ye Burgers vector jo hai wo parallel hai ye mera 3D mein representation ho gaya screw dislocation ka.

tha ye slip part hai aur ye unslipped part hai toh mere paas slip aur unslipped part ho gaya aur dislocation line isko demarcate kar raha hai ki slip kaun sa part hai aur unslipped part kaun hai.

Abhi hum dekhenge dislocation line ka movement kis tarah se ho raha hai toh humne jaise edge dislocation ke liye likha tha waise hum screw dislocation ke liye do points kuch likh lete ki jo direction of dislocation movement hai is parallel to the dislocation. Toh agar hum dekhenge ki ye jo direction movement hai theek hai toh ye jo dislocation line hai iske parallel nahi ye hamesha perpendicular hoga yahan par main correct kar leta hoon ye perpendicular hona chahiye Direction of dislocation movement is perpendicular to the dislocation line aur The direction of dislocation movement or dislocation line is perpendicular to the direction of stress agar hum dekhenge ki ye stress maine yahan par apply kiya tha shear stress is tarah se apply kiya tha aur mera movement mil raha hai is direction mein agar main shear stress is tarah se apply kiya toh movement mil raha hai is direction mein toh aap dekhenge ki ye jo movement hai edge dislocation ka agar main shear stress is direction mein apply kar raha hoon toh mera dislocation line is tarah se move ho raha hai is direction mein move ho raha hai toh main keh sakta hoon ki direction of dislocation movement is perpendicular to the direction of stress. Pehle part mein humne dekha tha ki jo dislocation movement hai ye perpendicular hai to the dislocation line hoga kyunki dislocation line yahan pe hai aur ye jo movement hai is tarah se move ho rahi hai yahan pe main yahan pe tha aur agar main yahan par pahunch raha hoon toh ye jo movement hai ye perpendicular hai dislocation line ke ye meri dislocation line hai yahan par jo movement hai ye hamesha perpendicular hoti hai dislocation line ke screw mein bhi.

Screw dislocation

When a screw dislocation moves,

- ✓ The direction of dislocation movement is *perpendicular* to the dislocation (or dislocation line)
- ✓ The direction of dislocation movement (or dislocation line) is perpendicular to the direction of stress

<https://eniv.org/pdf/0810.5121.pdf>
 Dieter GE "Mechanical Metallurgy"

Toh humne dekha tha humne do cheez yahan pe dekhiye humne screw aur edge dislocation dekha yahan par abhi main thoda summarize karna chahta hoon humne edge dislocation dekha edge dislocation kya hota hai mera tangent vector perpendicular to mera Burgers vector aur screw mein kya hota hai mera tangent vector parallel to Burgers vector ye meri do definition ho gayi aur ye agar definition hai meri toh in dono ko main agar ye condition hamesha satisfy ho rahi hai in dono ko main kehta hoon pure edge ya pure screw. Abhi ye jo condition hai pure edge aur pure screw

mein humne do nature dekhe the ki agar pure edge aur pure screw mein do type ho sakte ek positive dislocation aur ek negative dislocation ye based on mere extra half plane kis tarah se hai us uske upar depend karega yahan par pure screw mein main dekhoonga mere paas do type hai yahan par bhi ek right hand screw aur ek left hand screw atomic movement kis aur atomic displacement kis tarah se hai uske hisaab hisaab se hum kahenge ki isko pure edge hai pure pure screw mein wo right handed hai ya left handed screw hai.

Abhi ke liye main yahan par rukta hoon next part mein hum dekhenge ki aur kya dislocations ho sakte hain yaani pure edge ya pure screw ke alawa aur koi dislocation hota hai ki nahi hota hai hum janenge next part dhanyavad.