Alloys

- Concentration 1% → not depends on area

"average" atom

- Bandgap engineering hard

→ Discussion of quantum wells

Type 1 vs Type 2

End of Ch. 8

→ Skipping more topics at end

- Thermoelectric

- Superlattices
  - Bloch oscillators
  - Electron tunneling (actually, maybe explain

Applied E → mobility bad

Because $V = \frac{1}{\text{speed}}$ for const $E$

Then $\dot{U} \sim V$

Un-existing U
Chapter 17: p-n Junction

What if you put them together?

What happens to $E_F$?
- Like p-type?
- Like n-type?
- In middle?
- Other?

Answer:

- real space, not k-space

How does that work?
- Charge diffuses across barrier
  - p-type picks up some extra holes
  - n-type

Electric field
- Shifts the band like this:

Potential energy for holes:

Potential energy for electrons:
\( \theta = \frac{kT \mathcal{N} J}{n_i^2} \)

Also called "source charge" region, because there will still be some positive charge left, so holes move electric field to the right.

If an ion remains, then electron-beam recombination, depletion region - about 10 cm long.

Local change in doped material.

Selects gate oxide.
n-p-n transistor ("early" transistors)

Apply voltage (field) to middle gate

Can control!

FET (most modern transistors)

If high enough voltage, can "pinch off" current
Scherer Beier - D S.C. + model

Fig 12.14

"simplified view"
distance ≤ 3 μm
LEDs - P-N junction

Voltage across region of space

Laser - in principle just LED with mirrors on sides

Electricity to keep upper state occupied

More common: thick CW

Need small gaps!