*SEMICONDUCTOR TECHNOLOGY

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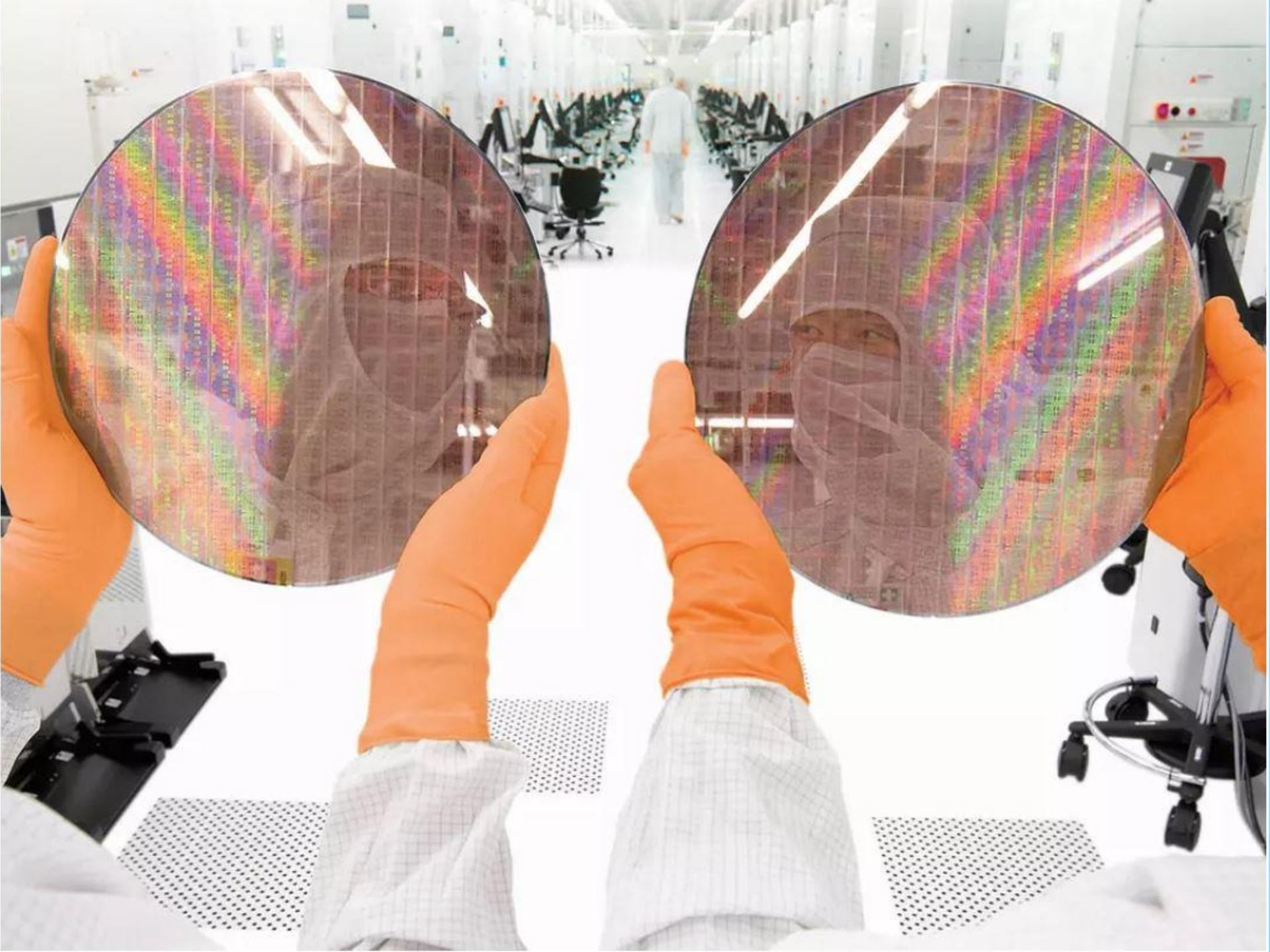
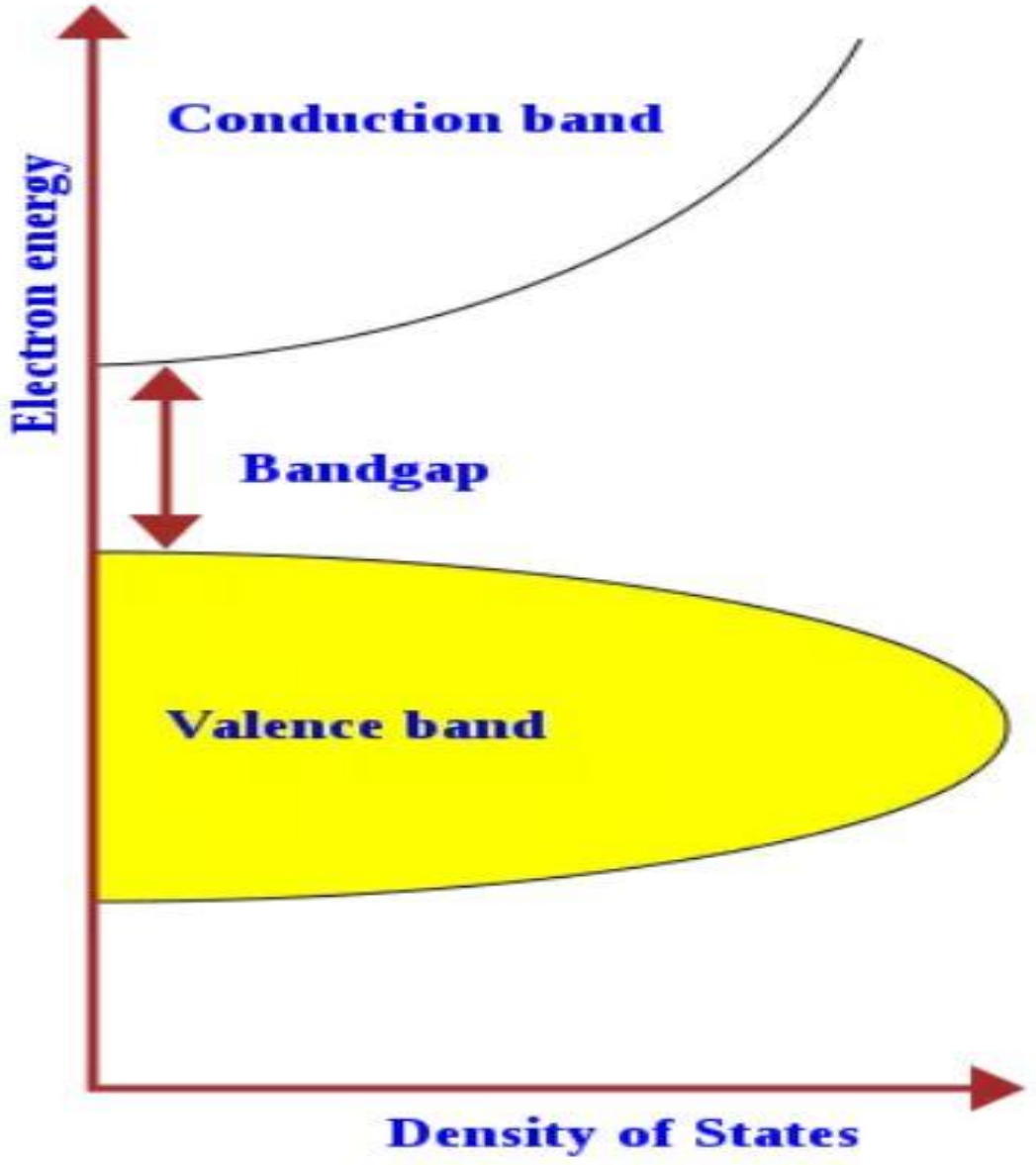
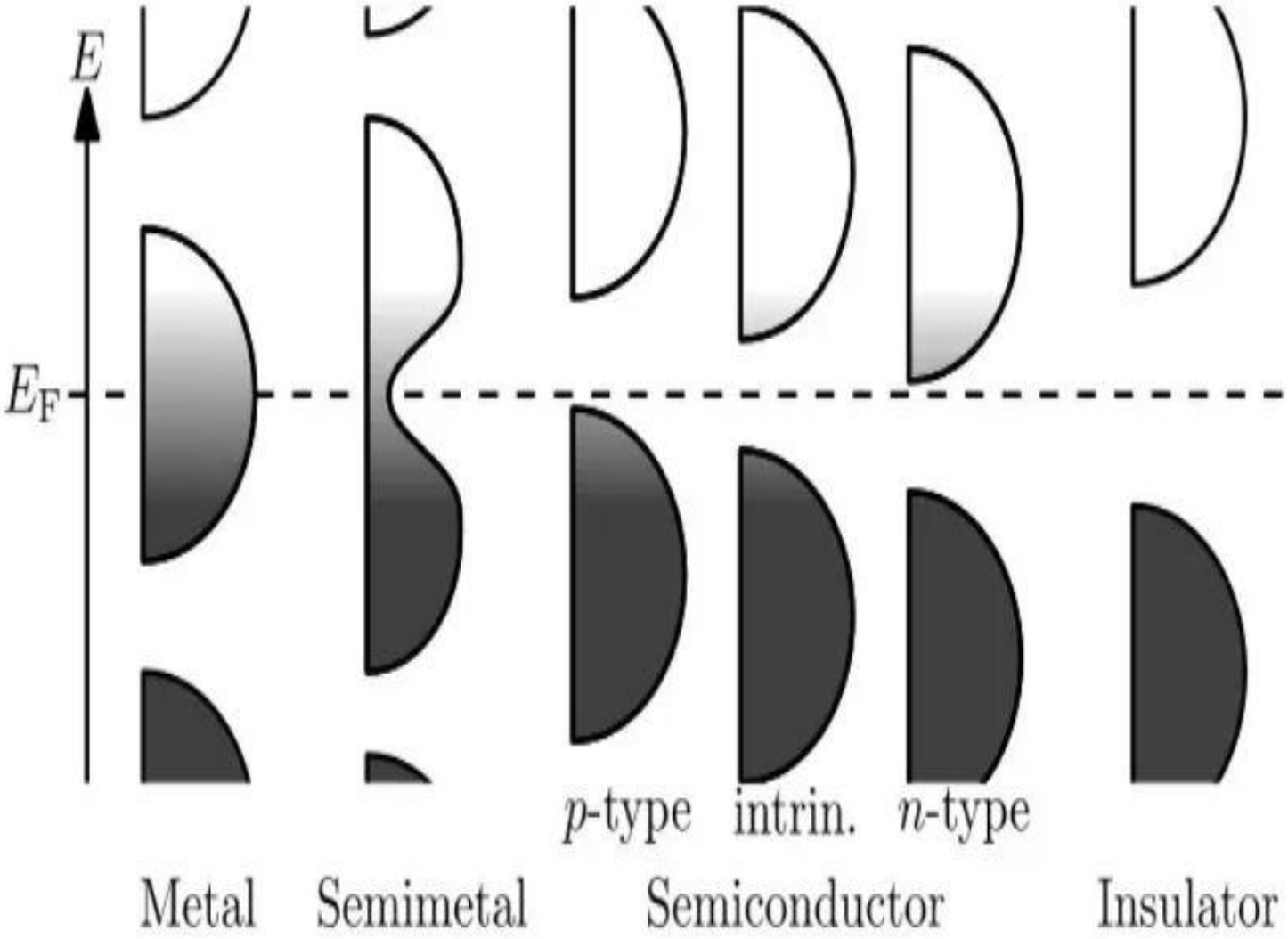




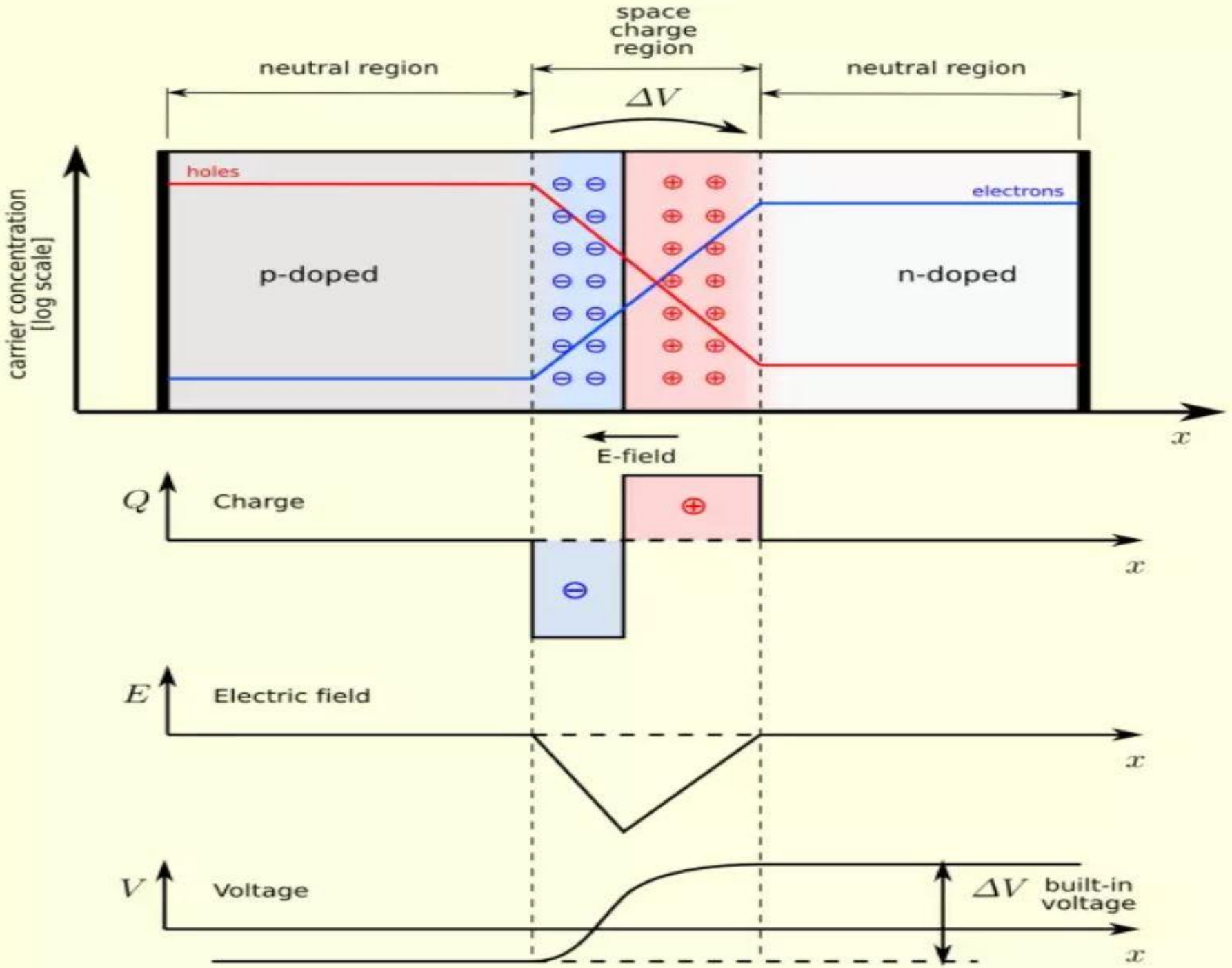
Its distinctive feature, like any other semiconductor, is considered to be its band structure, which is a collection of energy levels, which are formed by a large number of orbital positions on which electrons can be located.

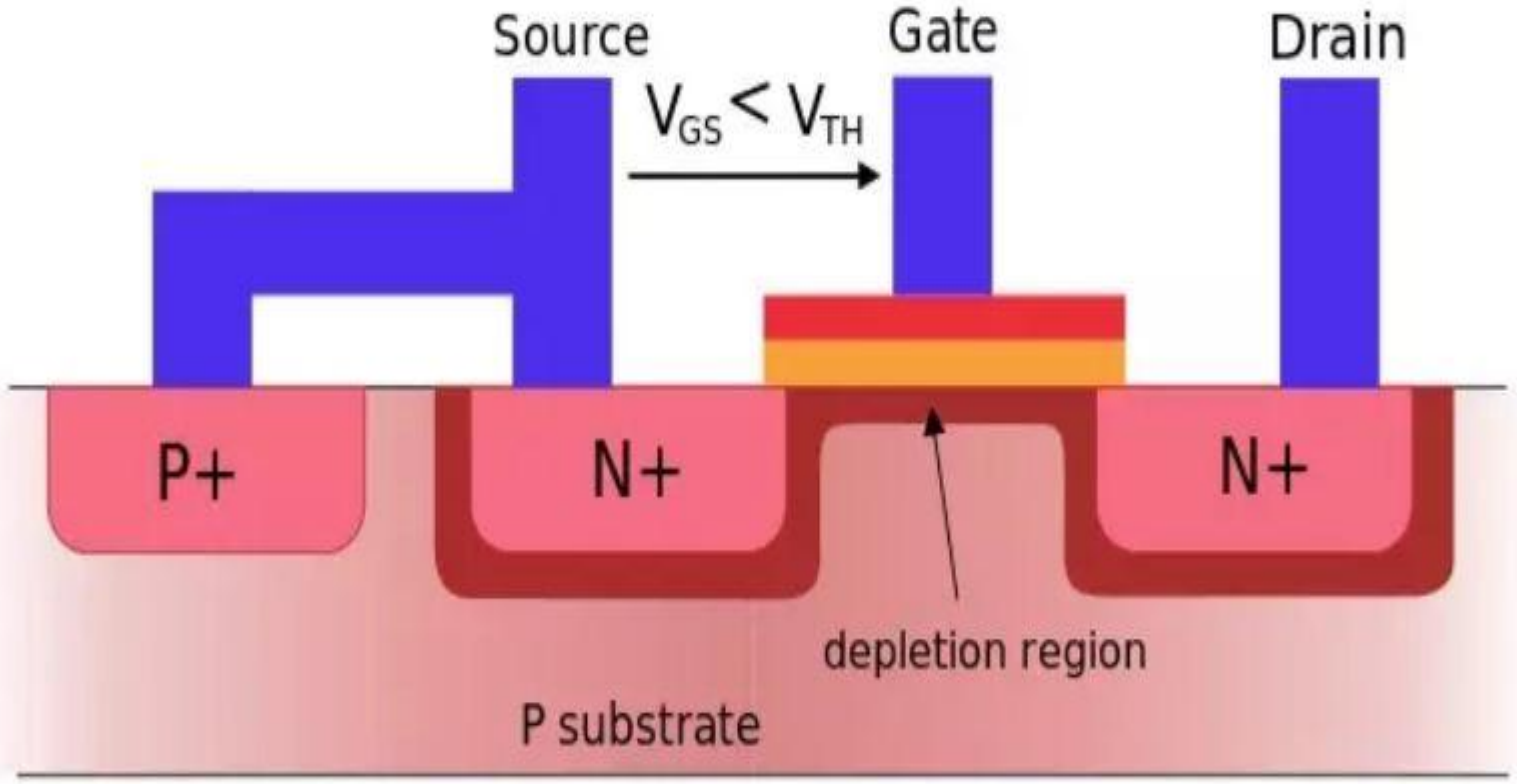
This is the position of the bandgap in a semiconductor crystal – between the valence band and the conduction band.

* In the band structure of semiconductors, there is such a parameter as the Fermi level, which in the screenshot above is designated as EF. It reflects the total amount of chemical potential energy for electrons at absolute zero, that is, at a temperature of 0 degrees Kelvin. Therefore, if the zone is located above the Fermi level, then its electrons can be separated from the atoms. Consequently, they can also conduct current. This zone is called the



* The most interesting processes begin when semiconductors of p- and n-types are arranged with each other. Since p-type semiconductors have “holes”, and n-type materials have an excess of electrons, a movement (diffusion) of electrons begins between them, which tries to equalize the charge in the compound. Due to diffusion, the connection region of the n-type semiconductor becomes positively charged, and the p-type negatively charged. This happens because in the process of diffusion a part of the n-type compound loses electrons, that is, it becomes positively charged. A p-type region, on the contrary, receives them and becomes negatively charged. As a result, an electric field is formed that prevents diffusion, and an equilibrium position is reached. The area where this process occurs is called the depletion layer. This layer received such a name for the reason that there are practically no mobile charge carriers in it, because of which it does not know how to conduct current.


space
charge
region
neutral region
neutral region
ΔV
holes
electrons
p-doped
n-doped
carrier concentration
[log scale]
x
E-field
Q
Charge
x
E
Electric field
x
V
Voltage
ΔV built-in
voltage
x



*The transistor has a relatively simple design, but at the same time there are some difficulties in its implementation. Such a transistor consists of four main parts: the source, the gate, the drain and the base. Let us dwell on the interaction of the first three components.

It is known from a physics course that a capacitor creates an electric field if there is a potential difference between its plates. In this case, due to the density of electrons and “holes”, the lines of the electric field cannot pass through the conductors. However, for semiconductors, this rule does not hold.

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