# A Review Paper on "Transparent Electronics"

**Bhawana Pareek[1] Deepak Kumar[2]**
[1]B. Tech Scholar [2]Assistant Professor
[1,2]Department of Electronics & Communication
[1,2]Vivekananda Institute of Technology, Jaipur

*Abstract*— Transparent electronics, an emerging science and technology field concentrates on producing 'invisible' electronic circuit. The application that contains consumer electronics such as automobile windshield, transparent display and real time display. In conventional Si / III-V based electronics, the structure depends upon the semiconductor junction & the transistor. The basic building material for transparent electronic devices is that it should be transparent and in visible range which offers a true challenge! Therefore to interpret and implement such technology we have two scientific goals, having a materials which are optically crystalline and electrically conductive and to prepare an invisible circuitry. Formation of such invisible transparent electronic devices needs expertise together from pure and applied science, chemistry, physics and electronic science.

***Key words:*** Transparent Electronics, VPE, R-SPE

## I. INTRODUCTION

The class of materials provided for transparent electronics have grown rapidly in the last decade. The TCO is widely used as an oxide material because it is both electrically conductive and optically transparent. These conductors are neither fully optically transparent nor metallically conductive. According to the structure, the combination of these two properties present in the same material is contradictory. A transparent material is an insulator which has completely filled valance band and empty conduction band while conductive materials have Fermi level of completely filled conduction and valance band.

The most widely used TCO are In2O3, SnO2, ZnO and CdO. Transparent conducting oxide like Sn doped In2O3; Al doped ZnO & Sb doped SnO2 are used for transparent LCD, light emitting diode & solar cell. TCO is used in transparent optoelectronics because it has a unique quality of becoming optically transparent in visible region.

## II. FABRICATION

Generally, epitaxial films of semiconductors are made by vapor phase epitaxy (VPE) techniques such as vacuum evaporation, chemical vapor deposition (CVD), molecular beam epitaxy (MBE).The VPE methods cannot be applied directly to the growth of TOSs as it becomes dominant at temperatures greater than 60% of the melting point of the compound. Therefore having a high- temperature deposition process have an intrinsic problem for the growth of complex oxides.

To resolve this difficulty in conventional VPE, new technique is found called solid-phase epitaxy (R-SPE). The reaction at such high temperature leads to the formation of a thin, single layer on the substrate InGaO3 (ZnO) with a layered super lattice structure.

Several types of transparent optoelectronic devices have been shown, such as p-type SrCu2O2 and n- type ZnO, UV-detectors are made of single crystalline p-type NiO and n-type ZnO, and have transparent thin-film transistors (aka . TTFTs) fabricated from single-crystalline InGaO3 (ZnO).

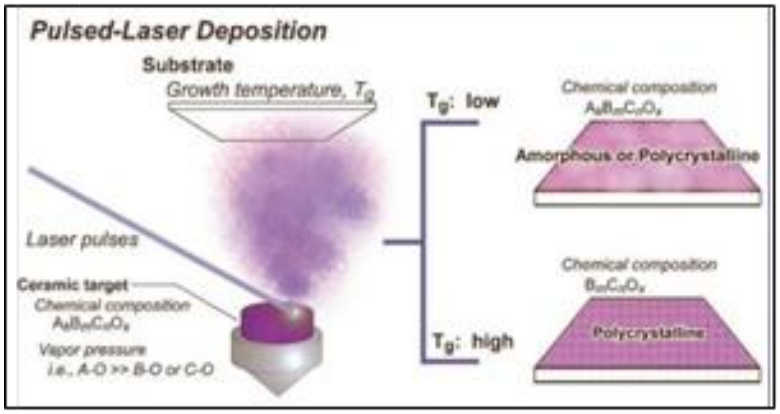


Fig. 1: Pulsed laser deposition process

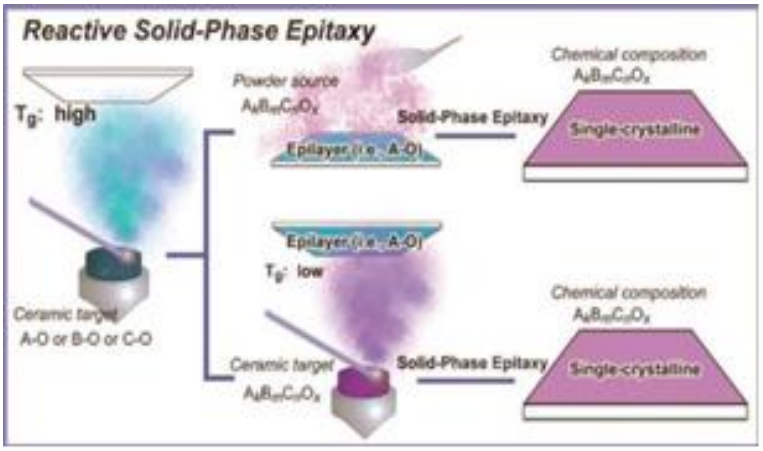


Fig. 2: Reactive solid phase epitaxy

Reactive solid phase epitaxy consists of three steps which are i) Bi-linear Fabrication, ii) surface- clapping & iii) thermal annealing. All these three steps are as described in figure 1 and figure 2.

## III. TRANSPARENT OPTO-ELECTRONIC DEVICES

### *A. Transparent thin film transistor:*

It is a special type of field-effect transistor formed by depositing thin films of a semiconductor active layer and the dielectric layer and metallic contacts on a supporting substrate. A common substrate is glass as the primary application of TFTs is used in liquid crystal displays. This differs from the conventional transistor in which the semiconductor material is the substrate, such as a silicon wafer.

### *B. Transparent UV detector:*

The UV radiation which reaches the surface of the Earth having a Wavelength of 280-400 nm (UV-A and UV- B), and has an important role in skin aging and cancer. The Portable UV-detectors, having a pn-junction of a large band gap semiconductor, is useful for monitoring UV radiation intensity. Although many UV-detectors have nowadays been developed with the use of pn- or Schottky-junction diodes of huge band gap semiconductors such as GaN, ZnSe, ZnS, and diamond, TOSs are used because they are optically transparent , environmental friendly, and thermal and chemical stable.

## IV. APPLICATIONS

Now days there is vast use of transparent electronics applications like OLED display transparent solar panel

### *A. Transparent OLED:*

Transparent OLEDs consists of only transparent components and when turned off, are transparent up to 85 percent transparent as its substrate. When a transparent OLED display is turned on, it makes light to travel in both directions. A transparent OLED display may be either active matrix or it can be passive-matrix. This technology can be used for heads- up displays.

### *B. Top-emitting OLED:*

Top-emitting OLEDs have a substrate that is can be opaque or reflective. They are mostly suitable for active- matrix design. Manufacturers can use top-emitting OLED displays in smart cards.

#### *1) Foldable OLED:*

Foldable OLEDs have substrates composed of very flexible metallic foils. Foldable OLEDs are extremely light weight and very durable. Their usage is in devices like cell phones and PDAs can lessen the breakage, a major cause of return or repair. Potentially, foldable OLED displays maybe connected to fabrics for creating electronic smart clothing, such as outdoor survival clothing with a computer chip, cell phone and OLED display sewn into it.

#### *2) White OLED:*

White OLEDs emits white light which is brighter, more uniform and more energy efficient than that which are emitted by fluorescent lights. White OLEDs also contains qualities of incandescent lighting. Because OLEDs are made in large sheets, they can replace fluorescent lights which are currently used in homes and buildings. Their use can potentially reduce energy costs for lighting.

## V. CONCLUSION

Transparent electronics are relatively new class of material which is applied to active devices such as TFT and UV detector. Combining of two properties gives lots of uses such as high mobility, low processing temperature, high performance and

flexibility. Transparent solar cell gives a tremendous advantage over conventional solar cell because it requires less space, produces more energy, eco-friendly and replaces the ordinary window glass and become a domestic electricity generator. So this new class of electronic is more advantageous than conventional electronics.

## REFERENCES

[1] Brody, T. Peter (November 1984). "The Thin Film Transistor-A Late Flowering Bloom". IEEE Transactionson Electron Devices31 (11):1614–1628.Doi:10.1109/T-ED.1984.21762
[2] www.en.wikipedia.org/wiki/OLED
[3] "AgelessOLED".Retrieved2009-11-16.
[4] Transparent electronics: from synthesis to applications', Wiley publications: Antonio Facchetti, TobinJ. Marks.