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Conducting/semiconducting films that are transparent to visible light

Transparent conductors and semiconductors have crucially important roles in applications such as for light emitting and light harvesting electronic devices including TV and computer display panels and solar cells. A metal can conduct but light cannot go through due to its almost zero band gap. On the other hand, a glass is transparent but not electrically conducting due to its large band gap. Driven by the great demand of transparent plus conducting materials in various current and future applications, a special type of material, transparent conductors/semicondutors, has been developed. Typical examples are ITO (indium tind oxide) and aluminium doped ZnO which are widely used as front electrodes for display panels and solar cells, owing to their optically transparent and eletrical conducting properties. Another less developed and more difficult filed is the active transparent semisonductor materials for various p-n junction devices. The major challenge is the development of performing p-type transparent semiconductors. In this presentation, both n-type and p-type semiconductor based on metal oxide and oxychalcogenide will be introduced, analyzed and discussed. Wide gap oxides have been intensively investigated as the potential transparent conductors (TCOs) and semiconductors (TCSs). A wide gap greater than 3 eV makes the material transparent in the visible light wavelength. However, the wide gap makes the material to be insulator generally. To make the material transparent optically and conducting electrically, great efforts have been made for decades. A lot of the TCOs and TSOs are impurity-incorporated oxides but they are usually n-type. P-type TCSs are very important in a wide range of electronic applications. For instance, p-type TCOs are reported to be more suitable for several device applications due to higher work function. More importantly, transparent electronics, which is a promising technology in our next generation display, needs high performance p-type TCOs to be functional to form p-n junctions.

Biography

Hao Gong has completed his PhD 26 years ago from Delft University of Technology, the Netherlands. He is a full Professor at Department of Materials Science and Technology, National University of Singapore. He has published more than 200 papers in reputed journals and has served as reviewer for more than 30 internation journals including Nature Communications, Advanced Materials, Nano Letter, ACS Nano, JACS, etc. He is an Editorial Board Member of scientific reports, and guest editor of some special issues of a few jounals. He has been Chairman for a few international conferences.

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