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THE FRONT EDGE OF MATERIALS SOCIETAL CHALLENGES

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Information and Communication Technologies (ICTs) are demanding for new ways of dealing with exponentially increasing volumes of information, which should be available anywhere, anytime, to everyone. In addition, last roadmaps from semiconductor industry and the EC SET Plan for Advanced Materials and Nanotechnologies point out the need to implement new materials in the next few years, as a way to overcome limitations concerning low scale integration, recyclability and material/processes costs. This spurs the search for technologies capable of delivering multifunctional electronic systems pursuing a "More than Moore" concept, where speed is considered together with properties such as flexibility and transparency.

Oxides are certainly one of the material classes with best possibilities to answer these demands. Oxides are known in electronics for more than a century and they are currently used in a broad range of applications, going from insulators in metal oxide semiconductor field effect transistors (MOSFETs) to transparent conductors in solar cells or liquid crystal displays (LCDs). In 2002, a totally disruptive concept was shown: a fully transparent thin-film transistor (TFT), using oxides for insulating, conductive and semiconductive layers. CENIMAT has been working over the last 15 years in oxides and particularly on their application to TFTs, being one of the world leading research groups in this area [1]. This presentation will provide an overview of our work in this area, focusing on oxide TFTs based on multicomponent oxide semiconductors as Gallium-Indium-Zinc Oxide (GIZO) or Zinc-Tin Oxide (ZTO) and their application to electronic circuits, including flexible OLED displays. But many other examples of the fascinating possibilities of oxides will be provided: the concept of electrochromic transistors [2], oxides enabling paper electronics [3], pH sensors, electrolyte-gated transistors, and even the usage of oxide nanoparticles for detection of an electrochemically active bacteria [3].

References

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