



MATERIALS FOR A BETTER LIFE ...

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## **Metal oxides: A Family of Materials that is Full of Potentialities**

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In the last 50 years we observed a drastic change in our daily life since society was never before so efficient and interconnected. This provides a collaborative environment that is essential for economic growth and progress like: Silicon Valley for microelectronic technology and Boston for biotechnology. This breakneck development has been in part dictated by an empirical technologically and economically driven rule known as “Moore’s law”. Indeed today a microprocessor has more than 7 billion integrated transistors in an area of 350 mm<sup>2</sup>. This unbelievable integration capability with higher processing speeds, memory capacity and functionality gives rise to what we call today: ubiquitous electronics. Despite the importance of Si technology there are applications where it is impossible, either technically or economically use it. Displays are the most notorious example, more if we want them to be flexible and conformable. With the intensification of cloud computing, the importance on the speed of the microprocessors is no longer so significant. The main unit of analysis is no longer the processor, but the rack of servers or the data centre and the interface/display (the human interface). Moore's law will come to an end in the near future. Taking this into account, the global semiconductor industry is seeking a new trend called “More-than-Moore”, where added values to devices are provided by incorporating functionalities that do not necessarily scale according to Moore's Law, where the driving force is not the miniaturization but the diversification by developing products with high added value. Over the last decades, human-device interactions have changed from text inputs to graphical user interfaces. Then, we really need to see how we can serve the multifaceted human interface! Another reality is the Internet of Things (IoT), which will transform our everyday life, from managing airports' passenger flow to heating buildings and caring for the elderly. The IoT is a revolution that promises to change people's lives, from inside the home to right across society. The reason why it will happen is because of the boom in low-cost computing, from which new platforms are needed. We at CENIMAT/i3N will contribute for a new era of interactivity, where, by exploring devices with multifunction's, interfaces can “see”, “hear”, “feel,” and “understand,” besides being self-powered, transforming our experiences with their contents of all form-factors to be more engaging and immersive. These advances coupled with remarkable innovations in sensing and display/interface technologies, will transform computing and communication systems. On the other way system-on-panel (SoP) concept has been proposed to enable various functional devices, such as driver, sensor, memory, energy storage devices and controller devices, to be integrated on a single panel for achieving high-performance, low-cost and more compact display and electronic products. To this we need the right technologies, eco and sustainable materials whose performances can be fully controlled and adjusted. But until now this concept was not successfully implemented since there was not available a unique technology simultaneously compatible with the low cost and the SoP needs. Recently transparent amorphous oxide semiconductors (TAOSs) have been attracting substantial attention as candidate materials for the use of thin film transistors (TFTs) for the next generation of flat panel displays (FPDs) technology due to their high carrier mobility, transparent to visible light, easy fabrication, and can be deposited at room temperature. In particular, due to their high electron mobility and uniformity all devices can be integrated on a panel, using the SoP technology.

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