Metal oxides: multifunctional materials for the new age of ICT

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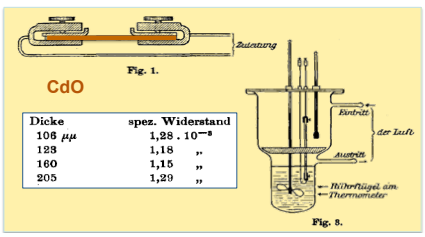
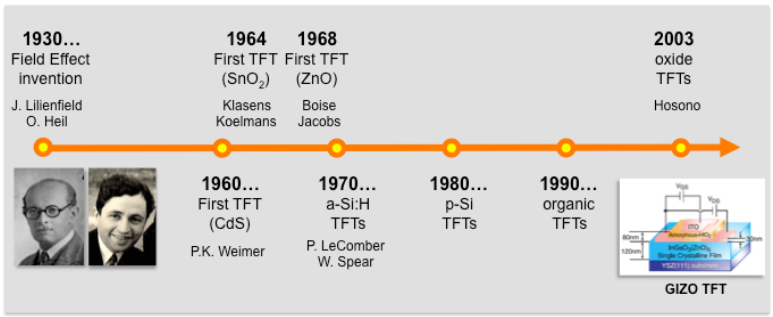
Before starting this presentation I just like to remind you that 10 years ago it was IMPOSSIBLE to use a metal oxide as a semiconductor layer at a thin film transistor (TFT). NOW we have companies selling products, especially in the display and ICT areas facing the needs to new generation of devices, with particular emphasis at South Coreia. But science is dynamic, and as a researcher we are always unsatisfied and we need to discover new solutions not only for existing problems but also for predicting the future. This is the big challenge where MATERIALS SCIENCE in conjunction with NANOTECHNOLOGY is pushed to the limit.

To decrease costs associated to electronic devices a strategy is using cheap and abundant materials in conjunction with low cost fabrication methods, associated to an overall increase of electrical performance.

Metal oxides (MO) are chemically stable, mostly non-toxic and abundant materials, often manufactured by low cost methods, under ambient conditions. Consequently, devices made of MO are inexpensive, very stable and environmentally safe, the 3 most important requirements for electronics. In many ways, oxides are unique materials. Despite being explored for more than a century for electronic applications, from the initial works of Badeker in 1907 with CdO to the cutting edge IGZO available these days in active matrix backplanes of flat panel displays, oxides still present an exceptional and innovative combination of properties not achievable by any other material class. In fact, they are true multifunctional materials, being able to exhibit optical transparency, conducting / semiconducting / insulating behaviour, piezoelectricity and catalytic or self-cleaning properties among many others.





In this presentation we will review some of the most promising new technologies based on oxide conductors, semiconductors, dielectrics as well as electrochromic devices either in the form of nano-films or nanoparticles, biosensors and we will summarize the major milestones already achieved with this emerging and very promising technology focused on the work developed in our laboratory. By using these materials and technologies we are contributing to the evolution of environmentally conscious electronics that is able to add new electronic functionalities onto surfaces, which currently are not used in this manner.

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