The SOI Transistor

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Abstract

SOI materials and transistors have been developed in parallel with the CMOS technology on bulk silicon. 60 years of SOI MOSFETs are briefly evoked, highlighting the milestones. The technology evolution has eventually achieved devices with sub-10 nm thickness where special mechanisms take place. The back-gate biasing, super-coupling, floating-body, volume inversion, and electrostatic doping are unique SOI concepts, inspiring the design of revolutionary devices. Selected examples include the core-shell junctionless transistor, the Hocus-Pocus Esaki diode and the sharp-switching band-modulation transistor.

Sorin Cristoloveanu received the PhD in Electronics (1976), the French Doctorat ès-Sciences in Physics (1981), and the Habilitation Diploma (1988) from Grenoble Polytechnic Institute, France. His professional career developed within the National Centre for Scientific Research (CNRS, France) as Director of Research for 40 years and then as Emeritus Director for 10 years. He is currently Chief Scientist of GIICS (Guangdong Institute of Integrated Circuits and Systems). He also worked at JPL (Pasadena), Motorola (Phoenix), and the Universities of Maryland, Florida, Vanderbilt, Western Australia, Kyungpook (World Class University project, Korea), and Nanjing. He served as director of LPCS Laboratory and Center for Advanced Projects in Microelectronics, initial seed of Minatec center. He authored more than 1,200 technical journal papers and communications at international conferences (including 170 invited contributions). He is the author or the editor of 36 books, and he has organized 35 international conferences. His expertise is in the area of device innovation, characterization and modeling of semiconductor materials and components, with special interest for silicon-on-insulator structures. He has supervised more than 110 PhD completions. With his students, he has received 17 Best Paper Awards, an Academy of Science Award (1995), and the Electronics Division Award of the Electrochemical Society (2002). He is a Life Fellow of IEEE, a Fellow of the Electrochemical Society, Doctor Honoris Causa of the University of Granada, and former Editor of Solid-State Electronics for 23 years. Since 2025, he is a Member of the European Academy of Sciences. He is the recipient of the IEEE Andy Grove award 2017, the most prestigious distinction in the field of electronic components, for contributions to 'silicon-on-insulator technology and thin body devices'. This is actually the topic of his last book https://www.sciencedirect.com/book/9780128196434/fully-depleted-silicon-on-insulator#book-info