MPHYCC-7 ELECTRONICS I

Unit 1: SEMICONDUCTOR

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ERA OF MATERIALS

As discussed earlier, for over 30 years the progress in semiconductor technology was dependent mainly on the improvements in ICs manufacturing processes, photolithography in particular. At the same time, developments that were highlighting the advancements were basically synonymous with pushing the boundaries of high-end logic and memory IC technology toward faster more potent circuits.

During the last decade the paradigm has shifted noticeably. With the exposure wavelength used in photolithography remaining unchanged the progress in CMOS technology was during the last decade achieved primarily through innovative materials engineering solutions combined with broader than ever before selection of materials used to process high-end devices. In parallel, major efforts geared toward drastic modifications of transistor’s architecture, moving toward 3D geometries, were undertaken. Developments in these two areas are likely to define progress in advance integrated circuit technology both digital and analog in the near future.

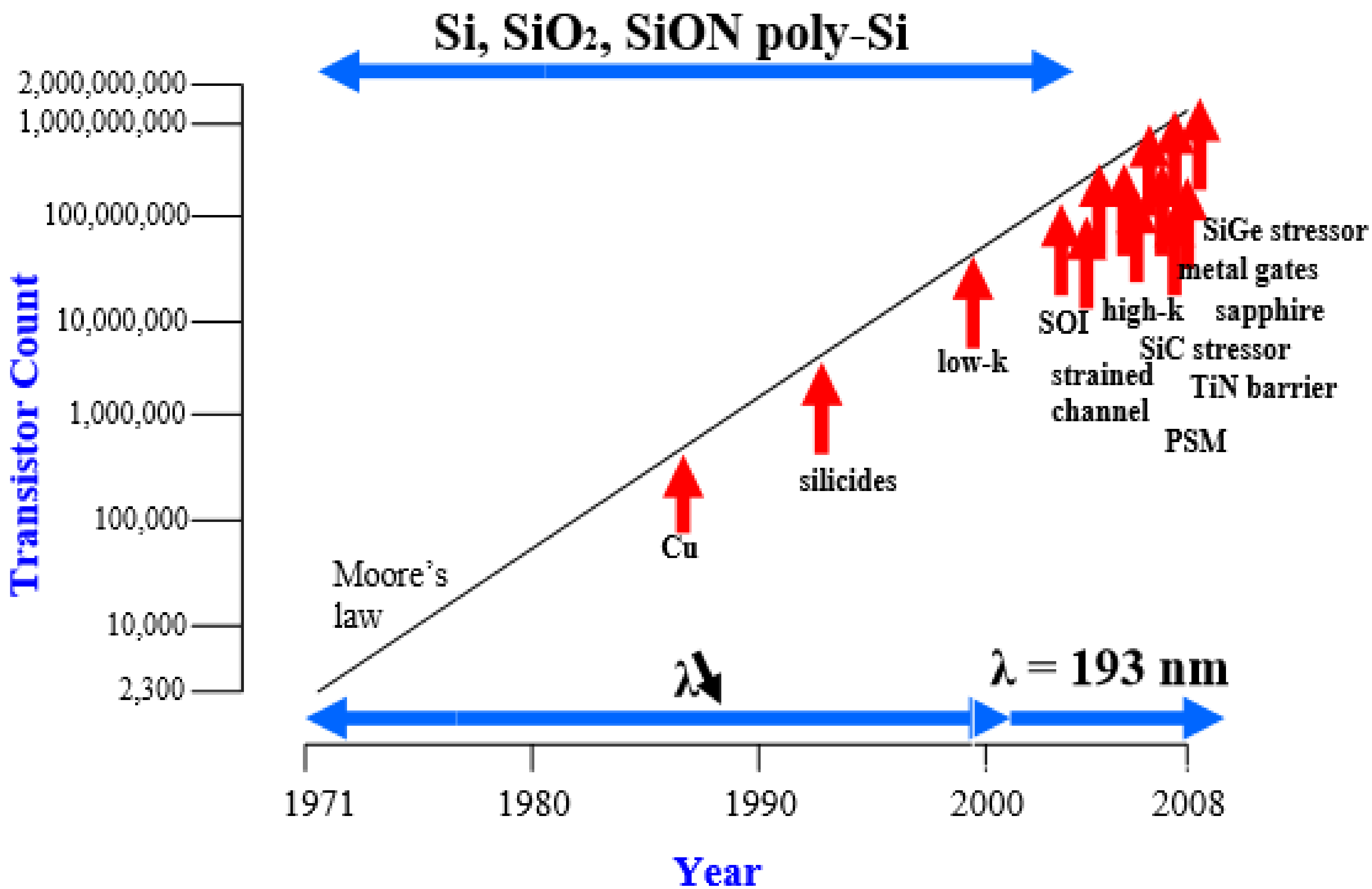

Fig. 5 *Growing contribution of materials engineering during the last decade - era of materials*

As a result, it is mostly all about the materials and the elaborately configured material systems these days. In fact, the latest process technology related breakthroughs are almost entirely related to materials engineering.

Figure 5 shows examples of materials related developments that took place in advanced ICs engineering during the last few years. Introduction of high-k gate dielectrics, accompanied by the need to address a range of challenges, use of SOI substrates and the use of stressors in the MOSFET channels are just a few highlights underscoring this trend.

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