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Submicron Si Technology: Present, Future and Impacts on Electronic Age

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Abstract

Seven years ago, a consolidated effort was undertaken at Bell laboratories to develop the fine-line silicon technology. A new laboratory was staffed with researchers from a wide variety of disciplines in order to apply a systems approach to this project. The new organization combined groups having knowledge in solid-state physics, device simulation, device design, materials science, device processing, electron-beam, x-ray and optical lithography, lithographic equipment development, and analytical techniques. This was a symbiotic assemblage unique in the semiconductor industry, and has achieved the desired goal: submicron features, and circuits operating with delay-times under 100 ps. Many advanced technologies are being developed at Bell laboratories as well as research laboratories around the world to extend our current capabilities to even smaller dimensions before we must contend with the fundamental 0.1 micrometer limit. The advanced technologies include precise pattern-transfer processes, lithography systems with 500 angstrom reslolution, low-resistivity interconnections, low-parasitic high-yield packaging approaches, radiation-enhanced CVD, rapid-thermal processes, and global simulation programs to facilitate VLSI/VHSIC circuit design and layout. Submicron silicon technology will have a profound effect on the electronic age. Many system-oriented integrated circuits containing millions of components will be built in response to the enormous market demand for sophisticated electronic applications. The world market of electronics is projected to reach two trillions dollars by year 2000. By then, it will rival the automobile, chemical, and steel industries in sales volume.