



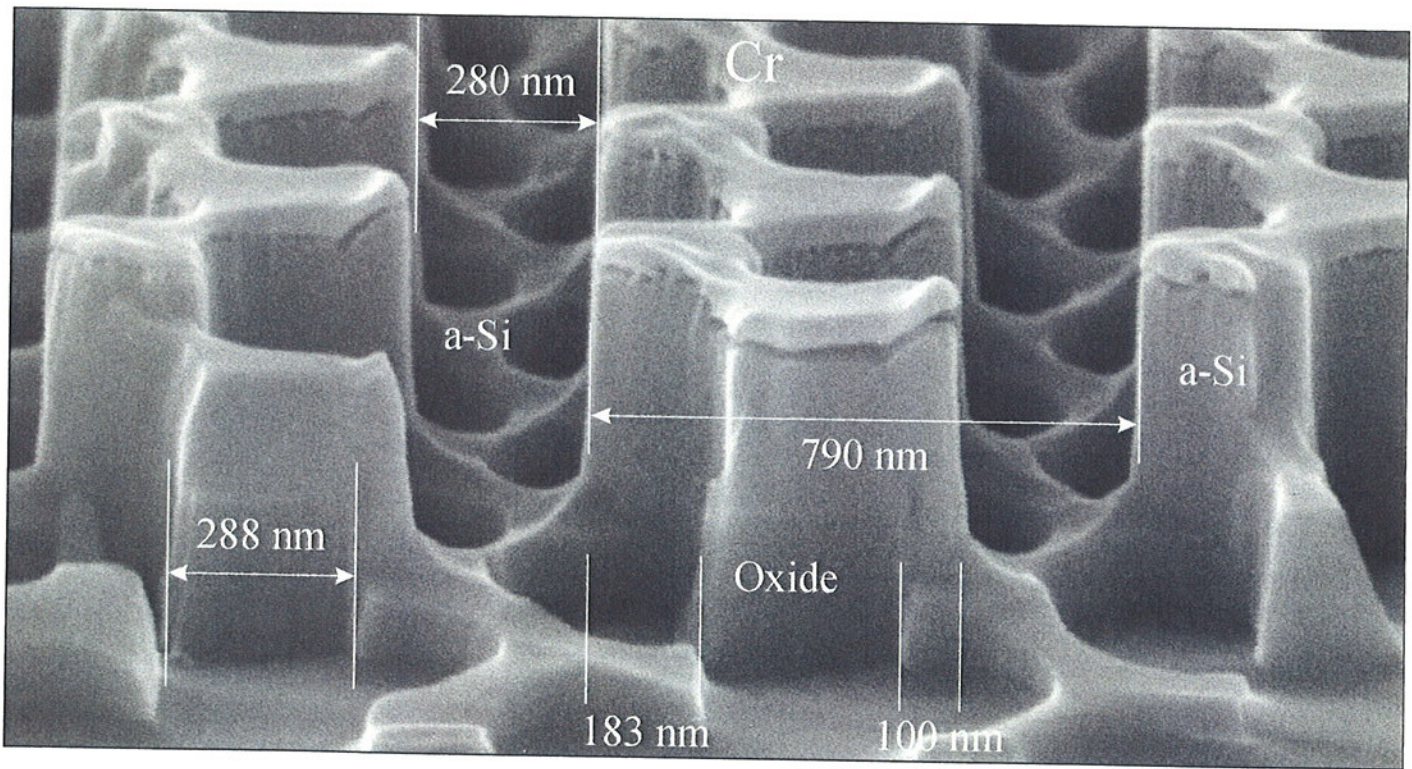
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THE FOUNDATIONS OF NEXT-GENERATION ELECTRONICS: Condensed-Matter Physics at RLE



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This scanning-electron micrograph shows an early stage in the fabrication of a three-dimensional photonic bandgap structure for the 1.5-micron wavelength. Photonic bandgap "crystals" are periodic lattices comprised of materials with very different dielectric constants. They can be used to manipulate and control light in much the same way that electronic crystals can control electrons. By adding defects to a photonic crystal, light can be confined to dimensions on the order of a wavelength. In this micrograph, the interleaved, complex pattern of the silicon-silicon dioxide structure is seen after formation of the second layer. Chromium is used for masking during a reactive-ion-etching step. The design, which enables planar nanofabrication technology to be used, was developed in Professor John D. Joannopoulos' group. Fabrication was performed at RLE's NanoStructures Laboratory under the direction of Professor Henry I. Smith. The creation of photonic bandgap materials has been made possible by a multidisciplinary research collaboration among several RLE physicists and electrical engineers (see articles on pages 14 and 18).