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Title & By-Line: ENHANCED LOW TEMPERATURE B ACTIVATION IN Si VIA NON-AMORPHIZING HIGH-ENERGY ION IMPLANTATION.
\underline{R.Kalyanaraman}, Washington University, St. Louis, MO, Oak Ridge National Laboratory, Oak Ridge, TN and Agere Systems, Murray Hill, NJ; C.S.Rafferty, H.-J.L.Gossmann, Agere Systems, Murray Hill, NJ. V.C.Venezia, Phillips Research, Leuven, Belgium and Agere Systems, Murray Hill, NJ; L.Pelaz, University of Valladolid, Valladolid, Spain and Agere Systems, Murray Hill, NJ; T.E.Haynes, Oak Ridge National Laboratory, Oak Ridge, TN.

Abstract Body: The ability to achieve efficient electrical activation of B in Si at low temperatures (T) has been an important goal in Si processing research. The main limitation to achieve efficient low T activation is related to the clustering phenomenon associated with B atoms, which is enhanced by the presence of interstitial atoms. The most successful approach to achieve low T activation has been via epitaxial regrowth of amorphized Si implanted with B, where B clustering is found to be reduced. However, this approach faces limitations when the amorphized Si has an interface with a non-Si region. This is a likely situation with devices fabricated on heterogeneous substrates, like Si-on-Insulator. Here, a thin active device layer of Si sits on an insulator, like SiO$_{2}$. Consequently, epitaxial regrowth into a single crystal is not possible and hence alternate approaches must be discovered. Here, we demonstrate a new approach to achieve enhanced B activation at temperatures as low as 400^{o}C. The approach relies on generating a large concentration of excess vacancy clusters prior to the B implant. These excess vacancies are generated

by high-energy ion implantation in Si using 2-MeV Si in the dose range of 2x10^{15}-1x10^{16} atoms/cm^{2}. Amorphization is suppressed by holding the substrate at slightly elevated temperatures (~70^{o}C). We show that the electrical activation of 40-keV, 2x10^{14} cm^{-2} B implants is enhanced by more than a factor of 2 in the temperature range from 400 to 800^{o}C over the case without vacancies. We also discuss the vacancy concentration dependence of B-electrical activation. This approach will potentially allow low T activation of B doped Si on heterogeneous substrates.

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