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Invited Paper: I was invited by D. B. Poker

AN EFFICIENT PROCESS FOR SEPARATION OF THIN-FILMS IN BULK SiC UTILIZING H^+-ION-CUTTING TECHNIQUES

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Thin-film transfer by H^+-ion implantation offers exciting possibilities for forming heterostructures other than silicon-on-insulator (for which it was developed). However, as the technique is extended to include a wider range of materials and their combinations, it becomes important to understand the mechanism(s) responsible for ion-induced separation of thin layers from bulk material. In particular, there is a need to understand and optimize this process for a new class of semiconductors (i.e., wide band gap materials) targeted to replace silicon in a variety of device applications including power electronics. SiC, a leading contender for this role, would benefit greatly from this technology, if for no other reason than cost. Substantial savings would be realized if thin, single-crystal films of this material could be efficiently transferred to cheaper substrates (e.g., polycrystalline SiC). An extensive study of the separation mechanism was done in SiC with the intent to optimize implant processing to affect efficient separation while maintaining the quality of the transfer layer. A wide range of material and irradiation parameters where examined including processing temperature, sample orientation (i.e., channeled vs. random implantation), polytype differences, ion energy and dose, etc. Also, the effects of ion-induced damage were also studied by coimplantation in which other ion types were used to intentionally introduce defects into the lattice. The results will be discussed and, in most cases, compared with those obtained in Si under similar processing conditions. In most cases, the processing efficacy was evaluated by gauging the amount of exfoliation produced under given conditions.

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