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A Novel Technique for Detecting Trace Residues of Contamination on GaAs Surfaces before MBE Growth[1] JERRY LEE, KEN WEST, KIRK BALDWIN, LOREN PFEIFFER, Princeton University — To prepare a GaAs substrate for molecular beam epitaxial (MBE) growth, the nominal $\sim$ 3 nm native oxide is typically thermally desorbed in vacuum. To test the completeness of this desorption, we describe a technique, which combines MBE, thermal desorption, atomic force microscopy (AFM), reflection high-energy electron diffraction (RHEED), and secondary ion mass spectroscopy (SIMS), for detecting trace residues of contamination on (100) GaAs surfaces before MBE growth. At all desorption temperatures in the range 600 $^\circ$C to 665 $^\circ$C, our RHEED measurements show that the native oxide is largely desorbed within 2 min. However, the SIMS and AFM data indicate that a residue of sub-monolayer oxide invariably remains on the GaAs (100) surface, and tenaciously resists all further attempts at its removal by thermal desorption. Since thermal desorption of the native oxide has long been the standard technique before MBE growth, we suggest that all MBE growth of GaAs heterostructures has been through a partial monolayer of native oxide. We believe that this is the likely reason for the failure of high quality attempts at MBE growth of GaAs after lithographic patterning on a previously grown MBE structure.

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