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In situ Plasma Exposure for Improved Interfaces in Atomic Layer Deposited Dielectrics on GaSb LAURA RUPPALT, ERIN CLEVELAND, JAMES CHAMPLAIN, BRAD BOOS, SHARKA PROKES, BRIAN BENNETT, Naval Research Laboratory — Among compound semiconductors, GaSb possesses one of the highest hole mobilities, making it a promising candidate for p-channel devices for III-V-based MOS technologies. However, the requirement of a low-defect interface between the GaSb device layer and gate dielectric represents a formidable hurdle to full MOS implementation. Native oxidation of the GaSb surface typically results in a highly defective interface, trapping charge and preventing free Fermi level movement. Wet chemical approaches to removing the native oxide often lead to mixed, irreproducible results and fail to prevent rapid reoxidation upon atmospheric exposure. As an alternative to wet chemical treatments, we have investigated the use of in-situ H_2/Ar plasma for improving the interface between GaSb and atomic layer deposited (ALD) dielectrics. We have found that by exposing the native-oxide-covered GaSb to mild H_2/Ar plasma immediately prior to ALD of high-k dielectrics, one can decrease the density of interface states by two orders of magnitude, unpinning the Fermi level and enabling carrier modulation. The effectiveness of the treatment can be tuned by varying the RF plasma power, the plasma exposure time, or the substrate temperature during exposure, with higher powers, longer exposures, and higher temperatures (up to 300C) resulting in improved electrical interfaces.

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