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Anisotropic Cl_2-based ICP etching of III-Vs with the addition of Si-containing gases[1] L. GATILOVA, S. BOUCHOULE, G. PATRIARCHE, S. GUILET, CNRS-LPN — Anisotropic etching of III-Vs (InP, GaAs) is a key building-block for photonic devices. We previously showed that it is achieved in Cl_2-H_2 or HBr ICP discharges via a SiOx sidewall passivation mechanism, with Si and O originating from the etching of the reactor surfaces and/or of the silicon wafer generally used as a sample tray to etch III-V samples of small size. We showed that passivation is promoted by H addition in the gas phase. For industrial large-surface applications, we have investigated the effect of small SiH_4 or $SiCl_4$ addition to develop passivating chemistries independent of the sample tray. We show that anisotropic etching is maintained by fine adjustment of SiH_4-H_2/Cl_2 or $SiCl_4$-Cl_2/H_2 ratios, and conclude that the Cl/H ratio should be kept roughly constant to promote the formation of the SiOx layer. We show that smooth and anisotropic etching can be obtained using a new simpler SiH_4/Cl_2 chemistry. Ex-situ spatially-resolved EDX-TEM analysis of the passivation layer deposited on the InP etched sidewalls showed that this layer is changed from Si-rich silicon oxide to nano-crystalline silicon. We will further discuss the effect of controlled oxygen addition on the passivation mechanism, and the use of HBr/SiH_4 plasma for anisotropic etching of InP/GaAs-based heterostructures.

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