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Effects of Mask Misalignment and Wafer Misorientation on Silicon V-Groove Etching

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We present an analysis of nonuniform mask undercut which occurs during fabrication of V-grooves by anisotropic etching of silicon. Mask undercut is known to be highly sensitive to alignment of the etch window with the <110> crystal direction. We show that the configuration of the mask patterns defining the end of the groove has a strong influence on the uniformity of the mask undercut and whether the V-groove sidewalls are true {111} or near {111} planes. Mask patterns with closed ends result in V-grooves whose sides are true (111) planes after long etches; open-ended mask patterns result in V-grooves with near (111) planes. These results can be explained in terms of step generation and movement during the etching process. Displacements of the V-groove centerline as a function of mask misalignment angle and wafer surface misorientation are calculated.