Supporting Information

High Uniformity GaN Micro-pyramids and Platelets by Selective Area Growth

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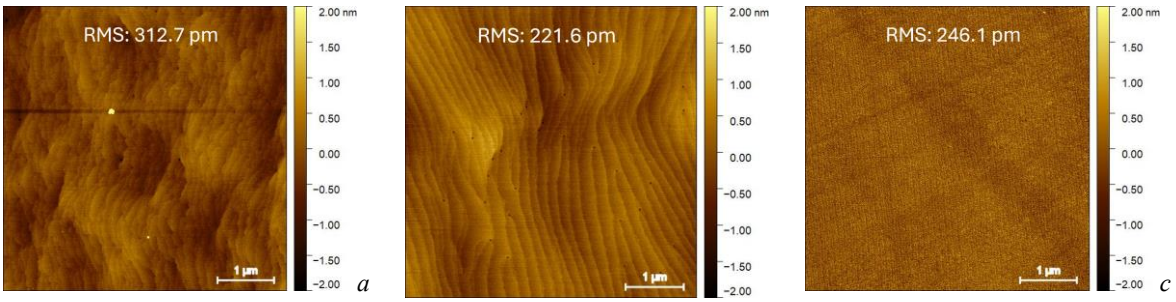
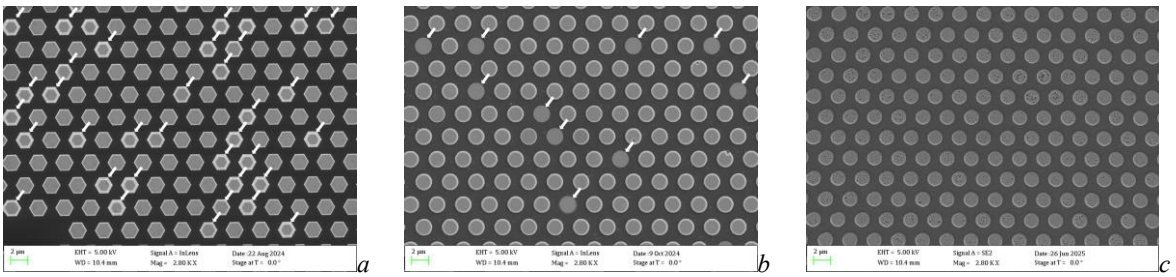
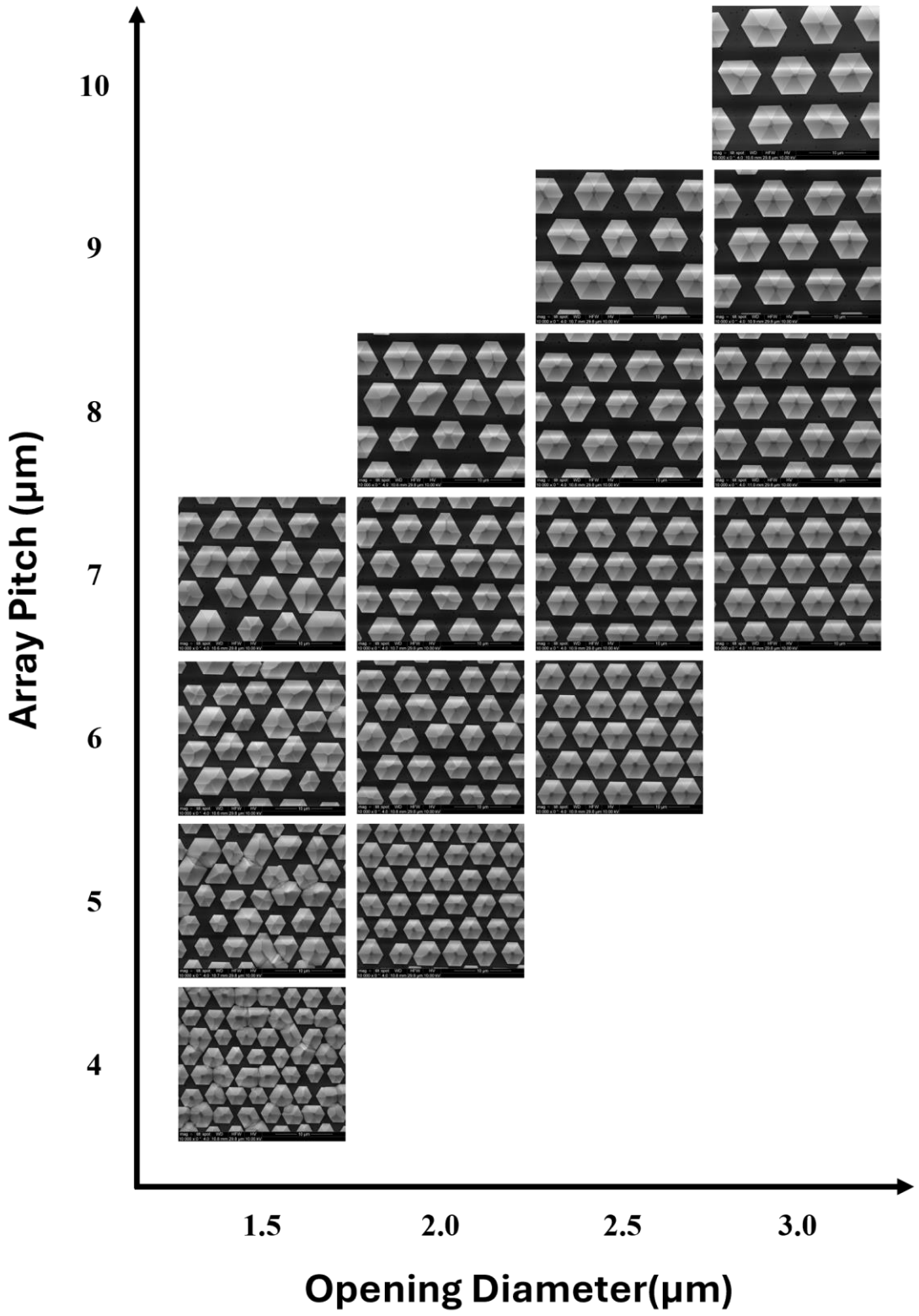


FigureS1. AFM surface morphology of the three templates used in this study: (a) Type *A* (GaN/AlN/sapphire), (b) Type *B* (GaN/sapphire), and (c) Type *C* (AlN/sapphire). All scans were acquired under identical AFM conditions.



FigureS2. Typical surface morphology of platelets on different templates under identical growth conditions: (*a*) template *A*, where taller platelets are indicated by arrows (35 platelets); (*b*) template *B*, where shorter platelets are indicated by arrows (10 platelets); (*c*) template *C*, where platelets have similar heights.



FigureS3. Top-view SEM images of GaN pyramids grown with different combinations of array pitch and opening diameter.

To evaluate the influence of pattern geometry on the growth behaviour, additional experiments were performed using a mask template containing arrays with different opening diameters and pitches. The opening diameter was varied from 1.5 μm to 3.0 μm, while the pitch ranged from 4 μm to 10 μm,

resulting in a total of 16 different arrays. The resulting GaN pyramids grown under identical conditions are summarized in Figure S3. The results show that the morphology and uniformity of the pyramids are primarily governed by the opening diameter, whereas the array pitch mainly influences the coalescence between neighbouring structures. For example, for arrays with the same opening diameter of 1.5 μm and pitches ranging from 4 to 7 μm, the pyramids exhibit similar distorted morphologies regardless of the pitch. The main difference is that smaller pitches lead to partial coalescence between neighbouring pyramids, while larger pitches provide sufficient space for the pyramids to remain isolated.

In contrast, when the pitch is fixed and the opening diameter is increased, the pyramids show improved uniformity. Larger opening diameter provides a wider nucleation area and allows more stable development of the crystallographic facets during selective-area growth, leading to better-defined pyramid shapes. It should be noted, however, that a certain level of uniformity is still observed even for larger opening diameter.