

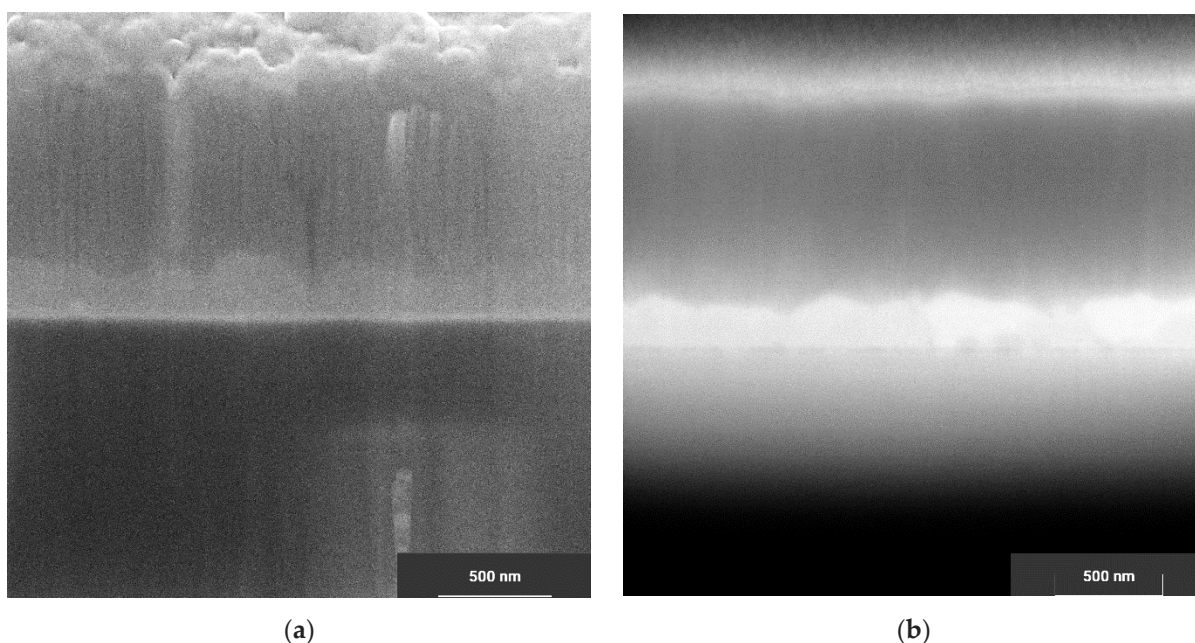
# Supplementary Materials: Characterization of Structure, Morphology, Optical and Electrical Properties of AlN–Al–V Multi-layer Thin Films Fabricated by Reactive DC Magnetron Sputtering

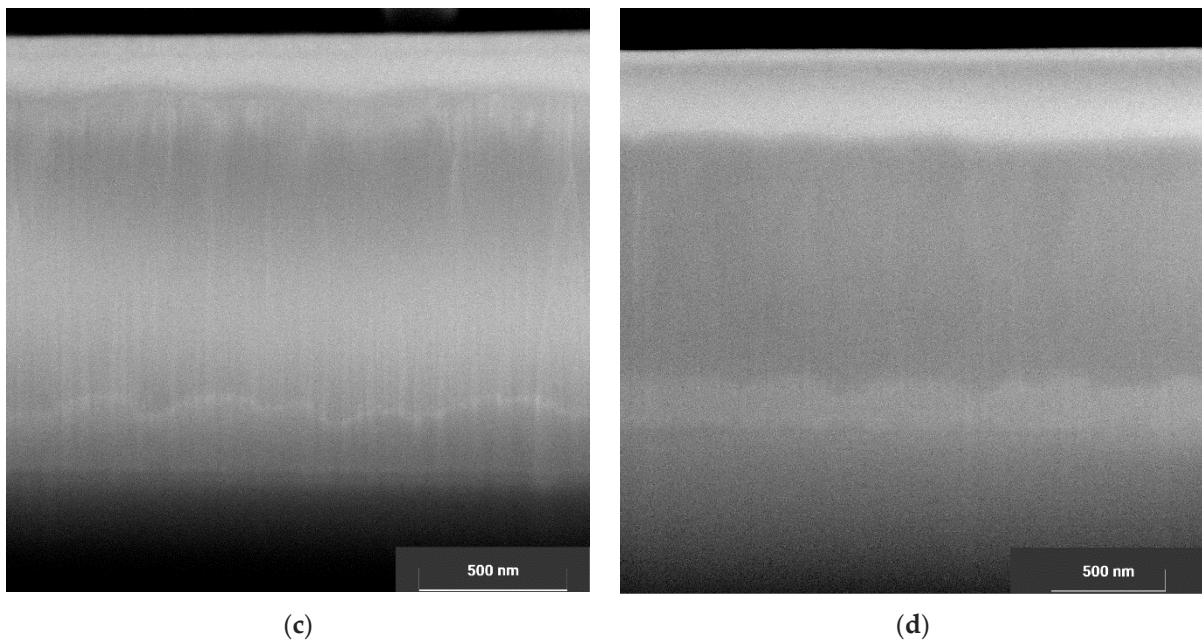
Maria I. Mironova <sup>1,\*</sup>, Aleksandr V. Kapishnikov <sup>1,2</sup>, Ghaithaa A. Hamoud <sup>1</sup>, Vladimir A. Volodin <sup>1,3</sup>, Ivan A. Azarov <sup>1,3</sup>, Ivan D. Yushkov <sup>1,3</sup>, Gennadiy N. Kamaev <sup>3</sup>, Evgeny A. Suprun <sup>2</sup>, Nikita A. Chirikov <sup>4</sup>, Nadim A. Davletkildiev <sup>4,5</sup>, Alexey N. Baidakov <sup>4</sup>, Vladimir S. Kovivchak <sup>4,5</sup>, Larisa V. Baranova <sup>4,5</sup>, Vladimir I. Strunin <sup>4,5</sup> and Pavel V. Geydt <sup>1,3,\*</sup>

- <sup>1</sup> Laboratory of Functional Diagnostics of Low-Dimensional Structures for Nanoelectronics, Novosibirsk State University, Pirogova Str. 2, 630090 Novosibirsk, Russia<sup>2</sup> Federal Research Center Boreskov Institute of Catalysis, Siberian Branch of the Russian Academy of Sciences, Prospect Lavrentieva, 5, 630090 Novosibirsk, Russia
  - <sup>3</sup> Rzhzanov Institute of Semiconductor Physics, Siberian Branch of the Russian Academy of Sciences, Lavrentyev Ave. 13, 630090 Novosibirsk, Russia
  - <sup>4</sup> Institute of Radiophysics and Physical Electronics, Omsk Scientific Center, Siberian Branch, Russian Academy of Sciences, 644024, Omsk, Russia
  - <sup>5</sup> Department of General and Experimental Physics, Dostoevsky Omsk State University, 644077 Omsk, Russia
- \* Correspondence: m.mironova@g.nsu.ru (M.I.M.); p.geydt@nsu.ru (P.V.G.)

## 1. SEM-Cross-Section Method Additional Results

Figure S1 shows SEM images of the cross-section of thin AlN films.



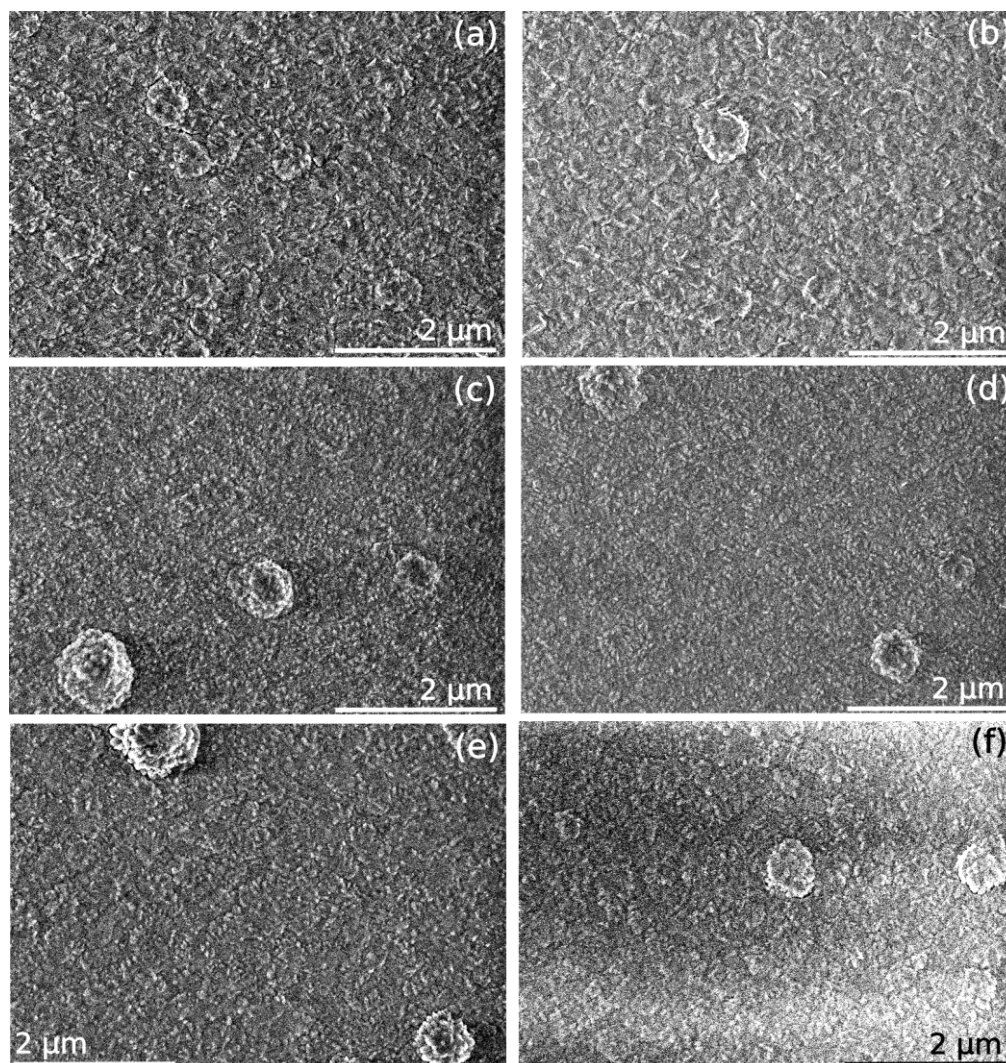


**Figure S1.** SEM cross-section images of AlN thin films on a silicon substrate: AlN-800 (a), AlN-700 (b), AlN-500 (c), AlN-400 (d).

Figure S1 shows that the Al layer has a high roughness. As a result, the AlN layer becomes disoriented and rough.

## 2. Scanning Electron Microscopy Top View Results Comparison

Figure S2 shows images of the surface morphology of AlN film samples.

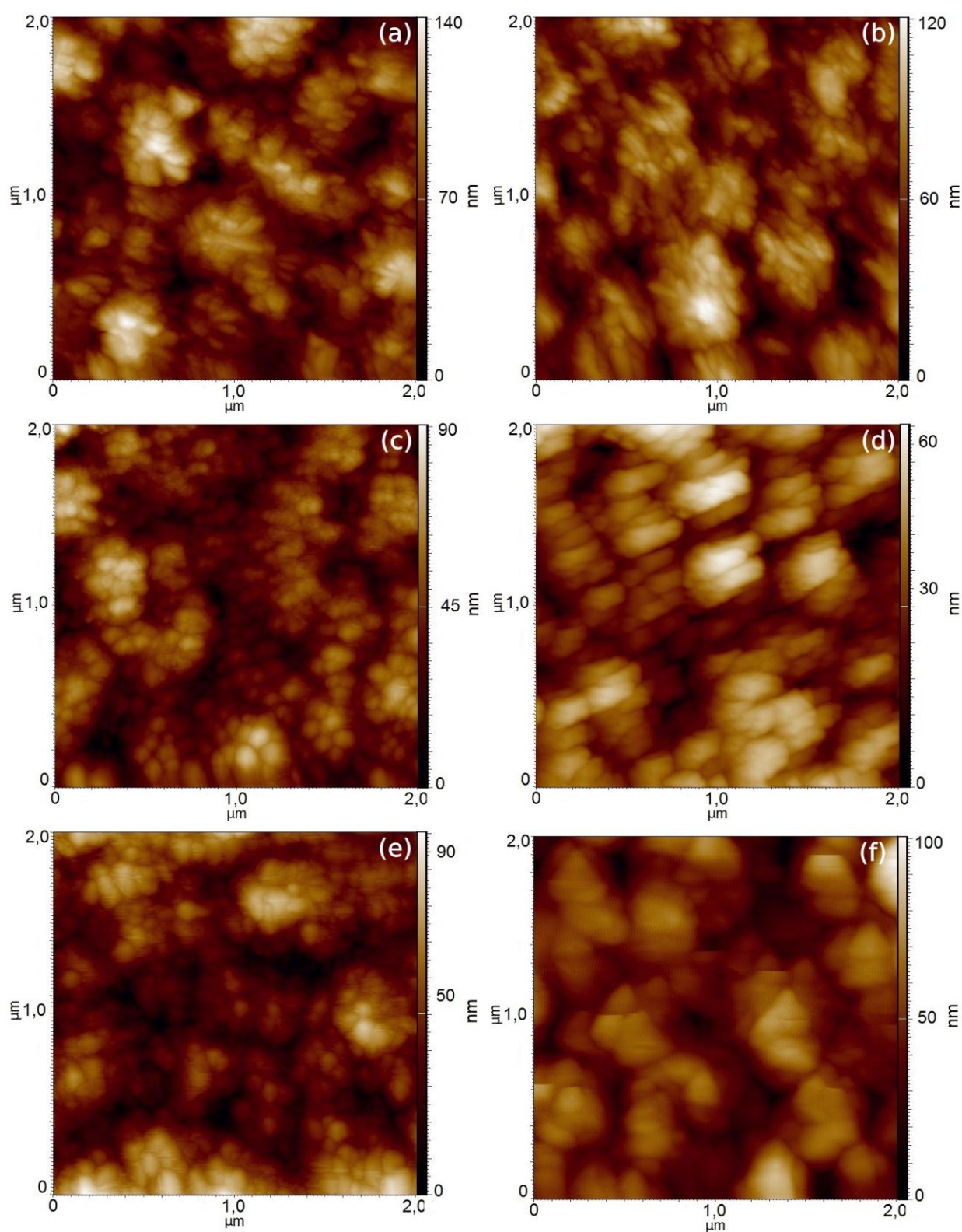


**Figure S2.** SEM images of AlN thin films on a silicon (left) and siall (right) substrates: AlN-400 (a,b), AlN-500 (c,d), AlN-700 (e,f).

From Figure S2 it can be seen that the SEM data correlate with the AFM data. The morphology of the surface does not depend on the type of substrate.

### 3. Atomic Force Microscopy 2D Morphology

Figure S3 shows AFM images of samples of AlN films on both substrates.



**Figure S3.** AFM images of AlN thin films on a silicon (left) and siall (right) substrates: AlN-400 (a,b), AlN-500 (c,d), AlN-700 (e,f).

As can be seen from Figure S3, the substrate material does not significantly affect the morphology of the surface.