論文 / 著書情報
Article / Book Information

題目(和文)	原子ステップサファイアc面基板由来のNiO系回折格子ナノ構造に関する研究
Title(English)	Study on NiO-Based Grating Nanostructure Derived from Atomically Stepped Sapphire (0001) Substrate
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論 文 要 約

専攻： Department of	物質科学創造　専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of　（　工学　）
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NiO has multifunctional properties, and can be used for UV detectors, electrochromic devices, organic solar cells, and UV-light emitting diodes as examples. Effectively controlling the size, morphology, and structure of NiO nanomaterials is imperative for applications involving the morphology-dependent properties. Hence, the development of NiO nanostructured materials is stimulating worldwide interests. According to previous works in my laboratory, periodic straight nanogroove arrays were formed on room-temperature pulsed laser deposited NiO(111) epitaxial thin films grown on atomically stepped sapphire (0001) substrates by annealing in air. To my knowledge, there are no other self-organizing formation methods of NiO periodic straight nanostructures that have potential applications for UV plasmonics and UV photonics, but the formation mechanism was unknown. Understanding the formation mechanism could conduce to the nanogroove size control for the industrial applications. Therefore, the influence of various conditions on the NiO periodic straight nanogroove array formation derived from the atomically stepped sapphire (0001) substrate was investigated. Firstly, the nanogroove array was formed via rapid thermal annealing (RTA) to optimize the formation time and to effectively fabricate the sample. The array formation took approximately 60 s at 973 K. The nanogroove formation process time reduced to 1/100 of the previous research. Secondly, the influence of the sapphire substrate terrace width on the array formation was investigated. The nanogroove periodicity corresponded well with the used substrate terrace width of the 0.22-nm-high stepped sapphire (0001) substrate. It was of great interest that the two types of 180°-rotated triangular crystalline domain were alternately grown on each film terrace divided by the nanogrooves. In addition, the two types of triangle crystals were not mixed on one film terrace. The origin of the morphology was important to understand the formation mechanism.