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*m*面AlInN/GaNヘテロ界面におけるカチオン秩序配列と自己形成組成変調超格子

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Self-formed compositional superlattices triggered by cation orderings in *m*-plane $Al_{1-x}In_xN$ on GaN

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$Al_{1-x}In_xN$の禁制帯幅波長は赤外線から深紫外線に渡り、ウイルス不活化等も可能な各種発光素子への応用が期待される。圧電分極電場の悪影響を回避可能な*m*面GaN基板において$Al_{1-x}In_xN$薄膜が組成変調超格子を自己形成するメカニズムを調べた。まず、*m*面GaN上のステップ端において1列目および2列目の$<\bar{1}\bar{1}20>$カチオン列がそれぞれAl原子およびIn原子により占有されやすいことが判明した。続く$<\bar{1}\bar{1}20>$Al列が2列目のIn列を挟み込むことにより、[0001]方向に$Al_{0.5}In_{0.5}N$と近似されるカチオン縞状配列が形成された。このカチオン配列が約5nm周期の$Al_{0.70}In_{0.30}N/Al_{0.74}In_{0.26}N$ $\{10\bar{1}2\}$超格子を形成する要因である。

$Al_{1-x}In_xN$ alloys are attractive media for realizing light-emitters operating in infrared to deep ultraviolet wavelength, which are applicable to disinfection of viruses. We exemplified the appearance and self-formation sequence of compositional superlattices in $Al_{1-x}In_xN$ films grown on *m*-plane GaN substrates, which can prevent the deleterious polarization-induced electric field. Initially, at a monolayer step edge of *m*-plane GaN, the first and second uppermost $<\bar{1}\bar{1}20>$ cation-rows are preferentially occupied by Al and In atoms, respectively. Subsequent coverage by next $<\bar{1}\bar{1}20>$ Al-row buried the $<\bar{1}\bar{1}20>$ In-row, producing nearly $Al_{0.5}In_{0.5}N$ cation-stripe ordering along [0001]. Such cation orderings lead to approximately 5-nm-period $Al_{0.70}In_{0.30}N/Al_{0.74}In_{0.26}N$ $\{10\bar{1}2\}$ superlattices as step-flow growth progresses.