Novel Processing of High Quality Aluminum Nitride Crystal using High Temperature Chemical Reaction Fields - Its Polarity and Growth Mechanism

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【Outline of survey】

Recent trend for semiconductor light emitting devices is headed for shorter wavelength and higher energy. Ultraviolet (UV) light emitting devices are expected for a variety of application: next generation light source, information technology, medical and biotechnology, excitation light source for photocatalysis and nanotechnology. Single crystalline AlN is an ideal material as a substrate for the UV LED from the viewpoints of lattice match and UV transmittance. There is strong competition among Japan, United States and EU to develop AlN crystal. It is extremely difficult to grow a bulk AlN crystal from its melt because of its high melting point and high sublimation pressure. Therefore, the HVPE, flux and sublimation-recondensation methods are currently employed for producing a bulk AlN crystal. However, the crystalline quality and size are far from satisfaction. The present study is positioned as the breakthrough for the limits of the current crystal growth technology. I developed a unique method forming AlN thin films by nitriding sapphire based on thermodynamic consideration. The purpose of this study is developing a new process of high quality AlN crystal with the help of the AlN film using high temperature chemical reaction fields. The crystal growth mechanism of AlN is also studied taking into account the polarity.

【Expected results】

High quality AlN crystal obtained by the present study will significantly contribute to make high luminous efficiency UV LED. Technical expertise on polarity and surface morphology control will be obtained through development of the process using high temperature chemical reaction fields. In addition, scientific contribution to the nitride crystal growth will be greatly expected.

【References by the principal investigator】

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【Term of project】 FY2008－2012	【Budget allocation】 75,800,000 yen (direct cost)

【Homepage address】 http://www.tagen.tohoku.ac.jp/labo/fukuyama/index-j.html