구두발표 I-4

Local magnetic moment induced by Ga vacancy defect in GaN

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Since the discovery of ferromagnetism in Mn doped semiconductor, a great amount of research efforts has been focusing on the magnetic properties of dilute magnetic semiconductors (DMS) primarily due to their peculiar physical properties promising for innovative spintronics applications. In DMS related studies one of the most essential issues is achieving a ferromagnetism at room temperature. It has been predicted that the transition metal doped wide band gap materials such as GaN and ZnO can maintain high critical temperature. Since then, these materials have received great attention. However, due to extensive studies with various DMS one can see many different types of materials showing room temperature ferromagnetism as well. It is believed that the transition metal dopant is required no matter what the hosting semiconductor material is. In addition, it is widely accepted that the doping concentration is also related to the critical temperature. Based on this concept various magnetic properties have been explored varying doping concentration and dopant types. On the other hand, it has been presented that the magnetic exchange interaction may depend the positions of transition metal dopants. In other words, the magnetic ground state changes from anti-ferromagnetic (AFM) to ferromagnetic (FM) or vice versa if the relative distance among dopants changes even for the fixed doping concentration. This result may indicate that one cannot overcome the issues of critical temperature and magnetic ground tate by increasing the doping ratio in a simple manner. Furthermore, some reports show that the ferromagnetism in DMS is riginated from extrinsic effect, for instance clustering of dopants or precipitation. Therefore, it is still debating on the origin of erromagnetism in DMS. Thus, the research interest has rather diminished because of unclear mechanism of ferromagnetism and various obstacles for applications. Here, using the state-of-the-art FLAPW method we study new possibility of observing ferromagnetism induced by vacancy defect in GaN. Very interestingly, it has been found that the GaN may display magnetic state in the presence of Ga vacancy, whereas the N vacacny structure has no sign of magnetic phase. In addition, the XAS and XMCD results are presented.