

Ferromagnetism in the non-magnetic oxides

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Recently we have confirmed that defect-induced ferromagnetism is possible in carbon such as graphite samples using x-ray magnetic circular dichroism (XMCD), which is a powerful tool for the investigation of the element specific magnetic property of materials.

One of the intriguing subjects in spintronics is the dilute magnetic semiconductors (DMS), where the origin of ferromagnetic order is not quite clearly demonstrated. Most of these materials were synthesized by introducing magnetic ions (e.g. Mn, Co, Fe, and etc) into conventional III-V and II-VI type semiconductors or wide bandgap semiconductors including ZnO and TiO₂. These bulk materials are intrinsically non-magnetic and electrically insulating. Also, HfO₂ has created intense debate as to the origin of magnetism. These materials are good templates for confirming the origin of the ferromagnetic order.

We have studied the surfaces of ZnO and HfO₂ thin films with the extrinsic defect produced by the high electron bombardment under different conditions, and then measured the XMCD. We will discuss the effect of magnetic polaron as an origin of this DMS materials.