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DILUTE MAGNETIC SEMICONDUCTORS

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Abstract

Dilute magnetic semiconductors are significant group of new materials that are interesting for spintronics devices if the ferromagnetism in these materials can be understood and controlled. These materials become ferromagnetic when doped with a few percent of transition metal ions. However, ferromagnetic behavior in dilute magnetic semiconductors is controversial. Numerous reports have claimed intrinsic ferromagnetism above room temperature, while a large number of others attribute these room temperature effects to impurities.

X-Ray absorption spectroscopy (XAS) with synchrotron radiation can provide crucial structural information to verify the existence of secondary ferromagnetic phases in dilute magnetic semiconductors. The application of two methods, XANES (X-ray Near Edge Absorption Spectroscopy) and EXAFS (Extended X-ray Absorption Fine Structure), provides a powerful tool for investigation of atomic and molecular structures of materials. These two methods enable direct measurements of valence state and local structure around atoms of a selected type in the sample – in our case dopants in the crystal structure of ferromagnetic semiconductors, and can significantly contribute to the determination of intrinsic ferromagnetism in dilute magnetic semiconductors.