^{1}H NMR Study of the Diluted Magnetic Semiconductor Mn-Doped ZnO

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As one of the best spintronics (spin+electronics) materials with potential technological applications, ZnO-based diluted magnetic semiconductors (DMSs) have initiated enormous scientific interest. In spite of tremendous efforts focusing on transition metal (tM) doped ZnO DMS, its origin of ferromagnetism has not yet been well understood and is still controversial. As a dominant extrinsic impurity defect, unintentionally doped hydrogen can mediate ferromagnetic ordering among the *t*M ions. Here, we employed magic-angle-spinning (MAS) ^{1}H nuclear magnetic resonance (NMR) to probe spin relaxation between proton and Mn ions in Mn-doped ZnO. Two distinct spin relaxation behaviors are found in the temperature range of 200 K to 400 K. The mechanism governing the relaxation is due to the dipolar interaction induced by the paramagnetic impurities of Mn ions, dominantly affecting below 300 K. Besides, NMR relaxation rate follows a Korringa relaxation, indicating a small density of carriers at the Fermi level above 300 K. The understanding of proton relaxation as a function of temperature opens an opportunity to study ZnO-based DMSs with NMR techniques.