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Gallium NMR Study of Type-I Clathrates WEIPING GOU, YANG LI, JI CHI, JOSEPH H. ROSS, Physics Department, Texas A&M University, TX 77843, G.S. NOLAS, Physics Department, University of South Florida, FL 33620 —
Clathrates are open framework structures containing guest atoms inside cages composed of silicon, germanium, or tin forming a crystalline framework. We carried out Ga NMR measurements on type-I clathrates, including $Sr_8Ga_{16}Ge_{30}$, $Ba_8Ga_{16}Ge_{30}$, $Ba_8Ga_{16}Sn_{30}$ and $Ba_8Ni_4Ga_{12}Ge_{30}$. For a $Ba_8Ga_{16}Ge_{30}$ sample with low carrier density, we find that the relaxation behavior (T_1) deviates from the Korringa relation, and the Knight shift and linewidth change with temperature. These results could be explained by carrier freezout in the Ba clathrate, and the development of a dilute set of magnetic moments due to these localized carriers. In the Sr clathrate, on the other hand, we see ordinary metallic behavior. In addition we see effects of slow atomic motion attributed to the dynamics of guest atoms in the cages. In $Ba_8Ga_{16}Sn_{30}$ and $Ba_8Ni_4Ga_{12}Ge_{30}$ samples, we observed 2 NMR peaks which correspond to 2 sites on the framework of clathrates, in contrast to the $Sr_8Ga_{16}Ge_{30}$ and $Ba_8Ga_{16}Ge_{30}$ clathrates for which a single site is observed. This work was supported by the Robert A. Welch Foundation, Grant No. A-1526, and by the NSF (DMR-0103455).

Weiping Gou
Texas A&M University

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