

Muonium Transitions in 4H Silicon Carbide

Y. G. Celebi¹, R. L. Lichti², H. N. Bani-Salameh², A. G. Meyer², B. R. Carroll²,
J. E. Vernon², P. J. C. King³ and S. F. J. Cox³

¹*Department of Physics, Istanbul University, 34459 Beyazit, Istanbul, Turkey*

²*Department of Physics, Texas Tech University, Lubbock, TX 79409-1051, USA*

³*ISIS Facility, CCLRC Rutherford Appleton Laboratory, Chilton, Oxon, OX11 0QX, UK*

Preliminary data for the temperature dependence of the low field amplitudes for the diamagnetic muon spin rotation signal in the three electrical types of 4H-SiC is presented and compared with those for the 6H poly-type [1]. Muonium hyperfine spectroscopy on all electrical types of 4H-SiC has shown at least two isotropic Mu^0 centers whereas a total of four are detected in the 6H poly-type [2]. Transverse field muon spin precession amplitudes on both poly-types of the SiC samples have shown two diamagnetic centers, Mu^+ and Mu^- , with strong evidence that promptly formed paramagnetic precursors are long lived on the μSR time scale. By probing these diamagnetic states, instead of their precursors, over a wide temperature range we have recently reported our results on the various muonium centers undergoing charge-state and site transitions in 6H-SiC. Temperature dependence of the diamagnetic muonium amplitudes in low transverse fields show complicated dynamics in 4H samples. Data we present for amplitude transitions at low temperatures in n – and p – type samples have the characteristics of carrier capture as were reported previously for 6H-SiC. At temperatures above 650 K the diamagnetic amplitudes together with their associated phases indicate slowly formed state in all of the electrical types of 4H samples. We will discuss possible site change and charge state transitions evident as steps in the temperature dependence of the diamagnetic amplitudes and their correlations with the previously reported neutral muonium centers [2]. We further present the sites tentatively assigned for the observed muonium centers in 4H poly-type. We discuss the similarities and disparities of the observed muonium species and their assigned sites in 4H samples with those observed in 6H structure [1].

[1] HN Bani-Salameh, et al, Physica B 401-402 (2007) 631.

[2] RL Lichti, WA Nussbaum, and KH Chow, Phys Rev B 70 (2004) 165204.