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Search of ultracold Mu generation material: μ SR study in SiC

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Ultracold muonium (UCMu) is an important muonium (Mu) source for the generation of ultraslow muon beam [1-3] for nanotechnological applications and understanding hydrogen dynamics in materials. In order to search a new solid material for the generation of UCMu in vacuum, we have studied n-Si [4], SiC and KCl at low temperatures (5 K –300 K) using conventional μ SR method. The relaxation rates of Mu formed deep inside (full-stop case) and near the rear surface (half-stop case) of the samples at low transverse field (TF 1.2 G) were observed. In n-Si, the difference in relaxation rates below 100K provided the hint for emission of Mu from the surface but the distance dependent study (distance of sample from silver sheet) shows that there is surface effect that causes the change of relaxation rate of Mu in half-stop case. In SiC, we have observed the Mu signal with high relaxation rate and the relaxation rates in full-stop and half-stop cases were found within error-bars. In KCl, we did not observe even a complete spin rotation signal of Mu below 100 K at TF 1.2 G field. In literatures, there is quantum diffusion of Mu in KCl is available [5,6]. In the program, we will present details about our measurement method and result in SiC.

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