The Features of Acceptor Center Formation by Negative Muon in Diamond and Silicon

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Theoretical explanation is given for essential difference between the formation of acceptor center (AC) by negative muon in diamond and similar process in silicon. It is shown that in diamond the acceptor center $^\mu$B$^-$ formation occurs not so rapidly as in silicon and takes more than $10^9$ s, because in contrast to silicon the probability of electron capture process from valence band due to auger-effect is negligible in diamond. The absence of paramagnetic shift of muon precession frequency in diamond [1] and the origin of muon polarization amplitude attenuation at temperatures higher than 40 K are explained by hole capture on ionized acceptor center $^\mu$B$^-$. The time dependence of charge-carriers density near the ionized AC was calculated. This dependence is not monotonic on the time interval less than $10^{13}$ s, which are not resolvable in $\mu$SR experiments. However it affects the behavior of polarization at $10^7$ s time scale. Thus $\mu$SR is able “to take a look” below its limit.