where E^0 is written in units of V/cm, W in W/cm^2, $k = d/\lambda$, and λ is the wavelength of the light wave in the medium. For example, when $W \sim 10^{12}$ W/cm^2 and $k \sim 10$ we have $E^0 \sim 10^3$ V/cm. It is now clear that in very narrow self-focused beams in a non-piezoelectric crystal the intensity of the time-constant electric field can exert a most appreciable influence on the properties of the medium.

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ELECTRON PARAMAGNETIC RESONANCE IN LITHIUM CONTAINING IMPURITIES OF GROUP IIB METALS

N. S. Garif'yanov, B. M. Khabibullin, E. G. Kharakhash'yan, and A. L. Bezzubov
Kazan' Physico-technical Institute, USSR Academy of Sciences

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The fact that the spin-lattice relaxation time T_1 of the conduction electron in lithium does not depend on the temperature, and the strong effect exerted on T_1 by the purity of the initial metal [1], give grounds for assuming that the main mechanism of spin relaxation is spin-orbit interaction of the conduction electrons with the impurity atoms. Therefore a study of solid solutions of different metals in lithium is of special interest. However, no systematic research has been carried out on the influence of controllable impurities on the EPR spectrum.

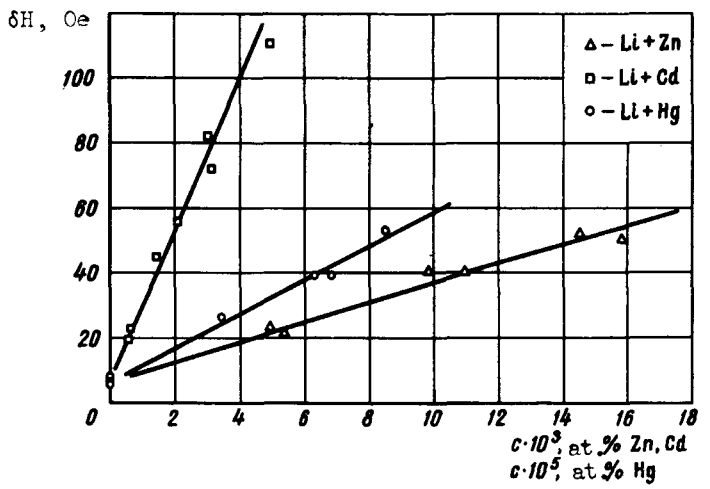
We report here the results of investigations of the effect of small admixtures of Zn, Cd, and Hg on the EPR line width in Li. As is well known [2], these metals form primary solid solutions in Li in a narrow range of concentrations. The initial material was ~99% pure LE-1 lithium (measured time $T_1 = 9.4 \times 10^{-9}$ sec). The alloy was prepared in an atmosphere of pure helium and dispersed by ultrasound in dehydrated paraffin to an average particle size $\lesssim 8$ μ. The measurements were made at 9320 MHz and room temperature.

It follows from the experimental data (see the figure) that the peak line width δH increases linearly with increasing c in the investigated concentration interval.

To estimate the spin-orbit interaction of the electrons with the impurity atoms in the metal, we used the expression given in [3] for the relaxation time:

$$\frac{1}{T_1} \simeq \frac{\omega^2_{LS} \cdot a}{v} f ,$$

where ω_{LS} is the energy of spin-orbit interaction between the conduction electron and the impurity, in frequency units, v is the Fermi velocity of the electron ($v \simeq 1.4 \times 10^{\omega}$ cm/sec in Li), a is the linear dimension of the region in which the relaxation interaction is sufficiently effective (we assume it to be equal to the dimension of the Wigner-Seitz cell, a = 3.5 Å for Li), and f is the atomic fraction of the impurity. The table lists the values of the spin-orbit interaction ω_{LS} obtained from (1), together with the values of the spin-orbit coupling ω^0_{LS} for free atoms [4], as well as the slopes δH/c of the experimental curves (see the figure).



Peak absorption-line width δH vs. atomic concentration c of the impurity.

T a b l e

	Zn	δH/c	ω_{LS}	ω^0_{LS}
Zn	30	$(2.9 \pm 0,3) \cdot 10^3$	$1.35 \cdot 10^{14}$	$1.1 \cdot 10^{14}$
Cd	48	$(2.3 \pm 0,2) \cdot 10^4$	$3.9 \cdot 10^{14}$	$3.2 \cdot 10^{14}$
Hg	80	$(5.0 \pm 0,5) \cdot 10^5$	$1.8 \cdot 10^{15}$	$1.1 \cdot 10^{15}$

It thus follows from our results that the spin-orbit coupling ω_{LS} between the conduction electron and the impurity atoms in a metal does not differ in order of magnitude from its value ω^0_{LS} for the free atoms. Consequently, the expected effect of screening of the spin-orbit interaction by conduction electrons is nonexistent. The contrary is more likely, that if the foregoing estimates are correct the redistribution of the electron density near the impurity atom leads to an antiscreening effect which apparently has a tendency to grow with increasing Z.

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