TABLE I

The head-origin separation and the rotational constants from the bands of the A-X system

Band	R head (cm.$^{-1}$)		Q head (cm.$^{-1}$)		$\nu_H - \nu_0$ (cm.$^{-1}$)		B″ (cm.$^{-1}$)		B′ (cm.$^{-1}$)		
	$Cu^{63}Cl^{35}$	$Cu^{65}Cl^{35}$	$Cu^{63}Cl^{35}$	$Cu^{65}Cl^{35}$	$Cu^{63}Cl^{35}$	$Cu^{65}Cl^{35}$	$Cu^{63}Cl^{35}$	$Cu^{65}Cl^{35}$*	$Cu^{63}Cl^{35}$	$Cu^{65}Cl^{35}$ (cal. from $Cu^{63}Cl^{35}$)	$Cu^{65}Cl^{35}$ (obs.)
0, 0	18997·33	..	18994·21	..	3·12	..	$0·1777_9$	0·1759	0·1682	0·1664	..
1, 1	18988·96	..	18985·78	..	3·18	..	$0·1767_5$	0·1749	0·1674	0·1656	..
0, 1	18583·25	18585·42	18579·77	18582·00	3·48	3·42	$0·1767_8$	0·1749	0·1682	0·1664	0·1664

* *Can. J. Phys.*, **40**, 412, 423 and 1443 (1962). B″ for $Cu^{63}Cl^{35}$ were calculated from B″ for $Cu^{65}Cl^{35}$

TABLE II

Molecular constants for the A state of CuCl

Molecule	B_e (cm.$^{-1}$)	α_e (cm.$^{-1}$)	r_e (Å)
$Cu^{63}Cl^{35}$	0·1686	0·0008	$2·108_9$
$Cu^{65}Cl^{35}$	0·1667	0·0007	$2·109_1$

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EVIDENCE OF THE INFLUENCE OF CRYSTAL DEFECTS ON THE ANNEALING OF CHEMICAL RADIATION DAMAGE

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MADDOCK AND CO-WORKERS[1] have recently shown that crystal defects determine the fate of the fragments generated in solids by the Szilard-Chalmers process, as well as the kinetics of subsequent annealing reactions. The possibility that crystal defects may equally be of importance in chemical radiation damage led Mohanty and Upadhyay[2-4] to the discovery that compression and crushing induce direct recovery of such damage and also accelerate the thermal annealing process. Andersen,[5] and Khare and Mohanty[6] have observed annealing in irradiated potassium bromate by compression. A brief account of some new observations on annealing in lead nitrate containing lattice defects introduced by doping and fast neutron bombardment is given below.

Homogeneous crystals of lead nitrate containing various concentrations of aluminium ions in the range 10^{-4} and 10^{-1} mole fraction were prepared by slow evaporation of aqueous solutions. Vacancies are generated by such addition of small concentrations of ions bearing a charge different to the corresponding ions in the host lattice. For example, it has been found that each calcium ion incorporated into a potassium chloride lattice results in the simultaneous inclusion of a cation vacancy.[7] Samples of the untreated and doped crystals were irradiated under identical conditions with 50 Mrad of ^{60}Co γ-radiations at the dose rate of 1·5 Mrad hr.$^{-1}$ The initial damage, measured as nitrite, was larger the higher the concentration of the impurity ions :

Al, Mole fraction	0	10^{-4}	10^{-3}	10^{-2}	10^{-1}
NO_2^-, ppm	1793	1909	1961	2085	2097

The thermal annealing characteristic for lead nitrate containing 10^{-2} mole fraction of aluminium is shown in Fig. 1 along with that for the untreated substance. It is seen that doping accelerates the annealing process. Thus, whereas the fraction φ of the initial damage annealed on 35 hr. heating at 150° C. was 0·366 for the untreated crystals it was 0·501 in the case of the doped material.

A comparison has been made of the initial damage and the thermal annealing behaviour

of lead nitrate irradiated with 50 Mrad of ^{60}Co γ-rays with the substance irradiated close to the reactor core so as to receive the above dose of γ-rays and, in addition, 5×10^{15} nvt fast and $2{\cdot}2 \times 10^{16}$ nvt slow neutrons. In the latter case,

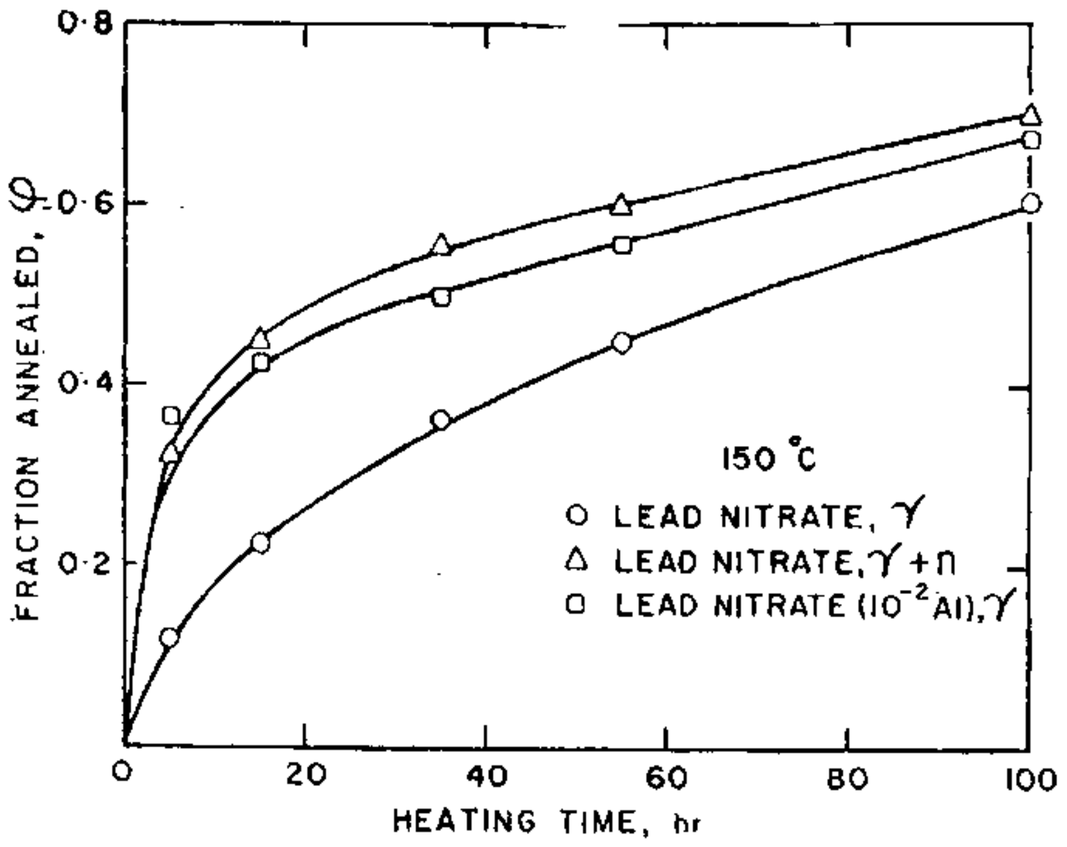

FIG. 1.

apart from the chemical damage produced by the γ-rays, and the 45 Kev ^{14}C atoms and the 0·56 Mev protons from the $^{14}N(n, p)^{14}C$ reaction, a considerable concentration of displacements is produced by the knock-on collisions of chiefly the fast neutrons. The initial chemical damage in irradiation with only γ-rays (1670 ppm) is smaller than that with γ-rays *plus* neutrons (2922 ppm). The annealing rate is higher in the latter case (Fig. 1). For example, the fraction annealed on 35 hr. heating at 150° C. was 0·366 for the γ-irradiated lead nitrate and 0·560 for the substance irradiated in the reactor. It has been already found[8] that the annealing characteristic at a given temperature is independent, over wide limits, of the energy, the dose rate and the dose of γ-rays. It would appear therefore that lattice defects are responsible for the higher annealing observed with the reactor irradiated lead nitrate than with the substance irradiated with only γ-rays.

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OXIDATION OF THIOUREA BY AMMONIUM HEXANITRATO CERATE IN TRI-*n*-BUTYL PHOSPHATE

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A SOLUTION of ammonium hexanitrato cerate in tri-*n*-butyl phosphate suitably diluted with carbon tetrachloride (1 : 4 by volume) has been observed to be a good oxidising agent for the potentiometric titrations of hydroquinone, sodium iodide, ascorbic acid, ferrous chloride and potassium ferrocyanide dissolved in either glacial acetic acid or TBP-carbon tetrachloride mixed solvent.[1] The same reagent taken in excess has been found to oxidise thiourea dissolved in glacial acetic acid quantitatively to formamidine disulphide base. One equivalent of the oxidising agent is consumed for every mole of thiourea. An analytical procedure has been evolved for the estimation of thiourea dissolved in acetic acid, based on this reaction.

0·02 M solution of ammonium hexanitrato cerate in the TBP-carbon tetrachloride mixed solvent is prepared from the stock solution. The exact strength of such a solution is determined before use by titrating with a standard solution of ferrous ammonium sulphate employing ferroin as an indicator. The strength of the oxidising agent is also checked by titrating potentiometrically with a standard solution of hydroquinone.[1]

0·025 M solution of thiourea is prepared by dissolving 0·09515 g. of recrystallized thiourea in 50 ml. of glacial acetic acid.

0·025 M solution of hydroquinone is prepared by dissolving 0·1376 g. hydroquinone in 50 ml. glacial acetic acid or TBP-carbon tetrachloride mixed solvent.