Atomic ^{35}S in an Alkali Chloride Matrix

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FOR more than twenty years it has been known that when ^{35}S is produced by the neutron irradiation of a crystalline alkali chloride, upon solution of the salt, in the presence of carriers, an appreciable proportion of the ^{35}S appears in oxidized forms, especially as sulphate. More recently it has been shown that the species in the crystal probably include sulphide ions and atomic sulphur.[1] The distribution of the ^{35}S between these, and possibly other forms, is closely related to the concentration and types of defects present in the crystals.

We have shown that the ^{35}S in such crystals is present in four distinguishable forms. These comprise sulphide ions, atomic sulphur, and two kinds of S–Cl complexes, formed by the interaction of the sulphur with *V* centres and their derivatives in the crystals.[2] An analytical technique permitting the determination of the properties of these four species will be described in detail elsewhere.

The formation of these four species is, however, in no way peculiar to ^{35}S produced by the (*n,p*) reaction. We have introduced ^{35}S into NaCl crystals by ion implantation using a 40 kev beam of ^{35}S^{+}. As can be seen in the Table the same four species appear. The two pieces of sodium chloride used were originally adjacent pieces cleaved from a single Kryopoulos grown crystal.

TABLE

Mode of production	Sulphur fraction			
	I	II	III	IV
	Measured as			
	S^{2-}	CNS^{-}	SO_3^{2-}	SO_4^{2-}
1. ^{35}S introduced by (*n,p*) reaction	46·1	9·6	21·5	22·8
2. ^{35}S introduced by ion implantation	46·4	26·4	17·7	9·5

The greater part of the sulphur introduced by the ion implantation penetrates less than 5μ, nonetheless the presence of air or oxygen after implantation has no appreciable effect on the distribution of the ^{35}S. This shows that even if the ^{35}S is quite close to the gas–solid interface the species yielding sulphite and sulphate upon solution are not increased by aerial oxidation.

The different concentrations and distributions of defects in the two preparations lead to differences in the annealing behaviour of the ^{35}S. These differences promise to facilitate the identification of the mechanisms of these processes.

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[1] C. Chiotan, I. Zamfir, and M. Szabo, *J. Inorg. Nuclear Chem.*, 1964, **26**, 1132; R. C. Milham, A. Adams, and J. E. Willard, Proceedings I.A.E.A. Conference on The Chemical Effects of Nuclear Transformations, Vienna 1964; STI/PUB 91 Vienna 1965, Vol. 2, p. 31; A. G. Maddock and R. M. Mirsky, *ibid.*, p. 41; K. Yoshihara, Ting-chia Huang, H. Ebihara, and N. Shibata, *Radiochim. Acta*, 1964, **3**, 185; J. Cifka and V. Bracokova, *J. Inorg. Nuclear Chem.*, 1966, **28**, 2483; J. Cifka and V. Kliment, *ibid.*, p. 1535.

[2] See also J. P. Meyer and J. P. Adloff, *Radiochim. Acta*, 1966, **6**, 217.