A NOTE ON THE USE OF COPPER AMMONIUM CHLORIDE TO DISSOLVE URANIUM METAL

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A Note on the Use of Copper Ammonium Chloride to Dissolve Uranium Metal*

This paper is presented not because of any quantitative results as a recommended method but because of the unusual nature of the reaction.

In a search for a procedure more suitable than the "acid insoluble" method for the determination of impurities in uranium metal, Poniński studied the solubility of uranium metal in copper ammonium chloride.⁽¹⁾ Williams had previously reported the successful determination of non metallic residues in iron powder by the use of the reagent.² Although uranium is unreactive in a copper sulfate solution, it is possible to dissolve 2 g of the massive metal in 100 ml of a solution containing 212 g of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and 155 g of NH_4Cl per liter of solution. Complete solution is indicated by the cessation of gas evolution and the resolution of the precipitated red copper. The pH changes during dissolving falling from an initial pH 8 to approximately 0.2. An inert atmosphere, nitrogen, was used during dissolution. The solution was filtered and the residue ignited.

The residues of all metal samples were black with no undissolved red copper. Preliminary studies of the solubility of uranium oxide and carbide in the reagent indicate the order of increasing solubility is UO_2 , U_3O_8 and UO_2 . However, no attempt was made to establish equilibrium conditions.

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Fryxell tested the theory that perhaps the severe pH drop when
 into solution is responsible for the solubility of the
 16g. (3) A buffered solution was prepared by dissolving
 10g. $\text{p/p} \cdot \text{H}_2\text{O}$ and 75g NH_4Cl in 800 ml of water. Forty two
 milliliters of HCl were added and the solution filtered and diluted
 to one liter. When one gram of uranium metal is dissolved in 100 ml,
 the pH falls from 3.2 to 2.6. Solubilities of black and brown oxides
 in the copper acetate-ammonium chloride mixture were found to be of
 the same order of magnitude as in copper ammonium chloride. The size
 of the sample and the length of contact evidently influenced the
 solubility.

It is doubtful that results obtained by either of the copper
 solution techniques are any more valid or meaningful than those of
 the HCl procedure.

(1) Harker, W. L., Metallurgical Laboratory Report CG-1047,
 p. 6, December 6, 1943.

(2) Villers, P., Z. anorg. allgem. Chem. 246, 46 (1941).

(3) Harker, W. L., Metallurgical Laboratory Report CG-1448, p. 7,
 March 4, 1944.

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