6.3 URANIUM METAL PRODUCTION

- Production of 450 Kg Uranium Metal Ingots in India

In India, for fabrication of research reactor fuel, production of uranium metal ingot was started in Uranium Metal Plant, BARC with the production of a 44 kg uranium ingot by calciothermic reduction of uranium tetra fluoride. Thereafter, in the intervening years, there has been a substantial scale up of production and extensive investigation of the metal and its compound. Recently in Uranium Extraction Division, an augmented uranium metal production facility (AUMP) for safe and secure production of 450 kg U ingot has been successfully commissioned by magnesiothermic reduction of uranium tetra fluoride.

- Pelletized Charge Magnesiothermic Reduction (MTR) for Production of U metal

Charge pellet was prepared under controlled atmosphere using hydraulic press. In a MgF₂ lined reactor of 5 Kg capacity, pelletized charge was randomly stacked and fired for completion of reaction. Pellets for handling could be prepared without compromising on the purity of product and recovery. This facility is to be scaled up to the required plant size.
Recovery of Uranium from Scrap U-Cu Cluster Generated during Fuel Fabrication

With the objective of maximising overall recovery in the fuel production cycle, a process has been developed to selectively remove copper from U-Cu clusters, and thereby making available the uranium for fuel fabrication without reprocessing. It involves preferential leaching of Cu with HNO₃ under controlled conditions. Uranium in the leach liquor (0.6%) is recovered as ammonium diuranate by ammonia precipitation. High recovery of 99.4% is achieved during solid-liquid separation. Typical batch size is ~100 Kg.

Production of Uranium Powder

A process has been developed for production of a specified grade uranium powder. It involves metallothermic reduction of UO₂. The product uranium powder is recovered by selective leaching of the slag mass at controlled condition. This has led to production of high purity metal powder of reproducible quality.

Study of Uranium Peroxide Precipitation for Reduction in Nitrate Waste

Studies were carried out with the objective of developing a process for UO₃ without generating nitrogenous liquid waste and obtaining UO₃ of required chemical purity and physical characteristics, suitable for uranium metal ingot production. Uranium compound (oxide or diuranate) is dissolved in sulphuric acid. Uranium is precipitated as UO₄ by maintaining stringent parameters and filtered to get UO₄ cake. The product UO₄ is chemically nuclear grade. The effluent generated in this process is disposable as per MPCB guidelines. Physical characteristics of the UO₄ and the UO₃ obtained after calcination are to be of suitable grade for further conversion to metal ingot.

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