December 1966 Brief 66-10639

NASA TECH BRIEF

Process for Preparing Dispersions of Alkali Metals

The problem:

To devise a convenient method of producing highly pure, finely divided particles of alkali metals (e.g., sodium and potassium).

The solution:

A method based on the fact that the alkali metals readily combine with certain aromatic compounds in selected solvents to form low-temperature soluble complexes from which the pure alkali metals precipitate quantitatively when the solutions are warmed.

How it's done:

The lower alkyl biphenyls (e.g., 4-ethyl biphenyl) and certain tertiary aromatic amines (e.g., N-ethyl carbazole) are effective quantitative complexing agents. Effective low-temperature solvents for the alkali metal complexes formed are certain hydrocarbon ethers (e.g., tetrahydrofuran and dimethoxyethane).

The alkali metal is dissolved directly from the solid at a relatively low temperature in a solution of the complexing agent and the preferred solvent. For example, N-ethyl carbazole, when dissolved in tetrahydrofuran, dissolves sodium in essentially equimolar quantity at approximately $-70°C$, and the pure metal is quantitatively precipitated as the solution approaches room temperature. The size and uniformity of the particles of the precipitated sodium are controllable over an appreciable range by variation of the rate of temperature change and the amount of agitation during precipitation. The precipitate can be removed by filtration, and the filtrate can be reused to dissolve more metal in a continuous process. The finely divided metal may be redispersed in a conventional manner in a suitable nonreactive liquid (e.g., petroleum ether).

During solution of the alkali metal, commonly occurring solid impurities remain behind and are readily removed by filtration in a preliminary step before precipitation of the alkali metal. If the original metal should contain an impurity that is soluble at the low temperature of the alkali metal reaction, such impurity is retained in solution during precipitation of the alkali metal.

Notes:

1. All operations involving the alkali metals must be carried out in an inert gas atmosphere.
2. Dispersions of alkali metals prepared by this method contained particles ranging from 1 to 10 microns in diameter.
3. Lithium was the only alkali metal tested which failed to precipitate quantitatively by this method.
4. This method may offer advantages for the preparation of pure alkali metals (e.g., sodium–potassium alloys) used in heat transfer loops, and as a means of coating the metals on temperature sensitive substrates. The alkali metal solutions or dispersions may also find use in organic syntheses.
5. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B66-10639

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Alan Rembaum and Robert F. Landel (JPL-734)

Category 03