



A Publication
of Reliable Methods
for the Preparation
of Organic Compounds

Working with Hazardous Chemicals

The procedures in *Organic Syntheses* are intended for use only by persons with proper training in experimental organic chemistry. All hazardous materials should be handled using the standard procedures for work with chemicals described in references such as "Prudent Practices in the Laboratory" (The National Academies Press, Washington, D.C., 2011; the full text can be accessed free of charge at http://www.nap.edu/catalog.php?record_id=12654). All chemical waste should be disposed of in accordance with local regulations. For general guidelines for the management of chemical waste, see Chapter 8 of Prudent Practices.

In some articles in *Organic Syntheses*, chemical-specific hazards are highlighted in red "Caution Notes" within a procedure. It is important to recognize that the absence of a caution note does not imply that no significant hazards are associated with the chemicals involved in that procedure. Prior to performing a reaction, a thorough risk assessment should be carried out that includes a review of the potential hazards associated with each chemical and experimental operation on the scale that is planned for the procedure. Guidelines for carrying out a risk assessment and for analyzing the hazards associated with chemicals can be found in Chapter 4 of Prudent Practices.

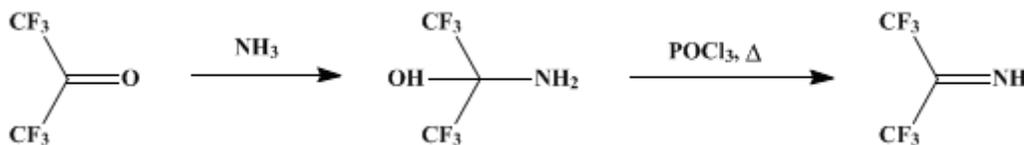
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These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

Organic Syntheses, Coll. Vol. 6, p.664 (1988); Vol. 50, p.81 (1970).

HEXAFLUOROACETONE IMINE

[2-Propanimine, 1,1,1,3,3,3-hexafluoro-]



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Checked by L. Scerbo and W. D. Emmons.

1. Procedure

Caution! This procedure should be conducted in a good hood to avoid exposure to ammonia and hexafluoroacetone.

A 3-l., four-necked, round-bottomed flask is equipped with a thermometer (-50° to 150°), a dry ice-cooled reflux condenser (protected from the atmosphere through a T-tube that is also connected to a nitrogen source and a Nujol bubbler), and a gas-inlet tube above the liquid level. The flask and condenser are heated in an air oven at 125° for several hours and flamed under nitrogen with a Bunsen burner. Pyridine (1.2 l.), previously dried over potassium hydroxide pellets, is added to the flask. A nitrogen atmosphere is maintained in the system, the pyridine is cooled to -40° , and 462 g. (2.78 moles) of hexafluoroacetone (b.p. -28°) is added from a cylinder through the gas-inlet tube over 30 minutes (Note 1), (Note 2), and (Note 3). Liquid ammonia (58.3 ml., 47.6 g., 2.80 moles), previously distilled into a cold trap and measured at -78° , is distilled into the pyridine solution over a period of 1 hour (Note 4). During this addition the bath is held at -45° to -40° , keeping the solution at -25° to -30° .

As soon as the ammonia has been added, the gas-inlet tube is replaced with a 250-ml. pressure-equalized dropping funnel and the reaction mixture is heated with a heating mantle to 40° over 30 minutes or as quickly as possible (Note 5). The dry ice-cooled condenser is then replaced with a 24-in. water-cooled bulb condenser with Tygon tubing joining the top of the condenser to a 300-ml. cold trap protected from the atmosphere with a calcium chloride drying tube and cooled in a bath maintained at -30° . The condenser is cooled with 18 – 20° water. The heating mantle is turned off, and the dropping funnel is charged with 394 g. (235 ml., 2.57 moles) of phosphorus oxychloride, which is added dropwise at a rate to maintain a gentle reflux. The imine (b.p. 16°) collects in the cold trap. When addition is complete, the reaction mixture is heated to 100° over 20 minutes and maintained at this temperature for 30 minutes. The cold trap collects 320–360 g. of crude liquid product (Note 6), which is distilled through a Podbielniak still with a reflux head temperature of about 0° (Note 7), yielding 254–291 g. (55–65%) of the purified imine, b.p. 15.5 – 17° (Note 8). It can be stored indefinitely in a stainless-steel cylinder.

2. Notes

1. Hexafluoroacetone may be obtained from E. I. du Pont de Nemours and Company, Inc., or Allied Chemical Corporation.
2. If it is inconvenient to add the hexafluoroacetone directly from a cylinder, it may first be condensed in a calibrated trap containing a boiling chip and cooled in an acetone–dry ice bath. When cooled to -78° , 462 g. of liquid hexafluoroacetone has a volume of *ca.* 280 ml. The hexafluoroacetone can be added to the reaction mixture by allowing it to boil slowly from the trap.
3. The bath is maintained at -40° , and the pyridine solution is maintained below -20° . Acetone, to which pieces of dry ice are added periodically to adjust the temperature, is a convenient cooling bath.
4. The ammonia can be prevented from bumping with a magnetic stirrer in the trap. Heat for the

distillation can be obtained from the air of the laboratory and by occasionally flushing the outside wall of the trap with room-temperature [acetone](#).

5. Prolonged heating decreases the yield.

6. For storage until Podbielniak distillation can be carried out, the product can be drained into an evacuated, 500-ml. stainless-steel cylinder.

7. The checkers used a 60-cm., vacuum-jacketed column packed with glass helices, with satisfactory results.

8. This preparation has been run in the submitters' laboratory at four times this scale with yields as high as 67%.

3. Discussion

[Hexafluoroacetone imine](#) has been prepared by the reaction of [hexafluoroacetone](#) with [triphenylphosphine imine](#),² by the pyrolysis of [N-phenyl-2,2-diaminohexafluoropropane](#),^{2,3} by the reaction of [hexafluorothioacetone](#) with hydrazoic acid,⁴ and by the reaction of [ammonia](#) and [phosphorus oxychloride](#) with [hexafluoroacetone](#).^{4,5} The latter method, described here, is the most convenient, as it does not require preparation of several intermediates or use of pressure equipment. This method has also been used to prepare the imines of other fluoroketones, including those of [chloropentafluoroacetone](#), [dichlorotetrafluoroacetone](#), and [perfluorodiethyl ketone](#).⁵ Substitution of [methylamine](#) for [ammonia](#) in this procedure gives the [N-methyl imine](#).⁵

This preparation is referenced from:

- [Org. Syn. Coll. Vol. 6, 161](#)

References and Notes

1. Central Research Department, Experimental Station, E. I. du Pont de Nemours and Company, Inc., Wilmington, Delaware 19898.
2. Yu. V. Zeifman, N. P. Gambaryan, and I. L. Knunyants, *Dokl. Akad. Nauk SSSR*, **153**, 1334 (1963).
3. Yu. V. Zeifman, N. P. Gambaryan, and I. L. Knunyants, *Izv. Akad. Nauk SSSR Ser. Khim.*, 450 (1965).
4. W. J. Middleton, U.S. Pat. 3,226,439 (1965).
5. W. J. Middleton and C. G. Krespan, *J. Org. Chem.*, **30**, 1398 (1965).

Appendix

Chemical Abstracts Nomenclature (Collective Index Number); (Registry Number)

[hydrazoic acid](#)

[ammonia](#) (7664-41-7)

[nitrogen](#) (7727-37-9)

[acetone](#) (67-64-1)

[Phosphorus Oxychloride](#) (21295-50-1)

[pyridine](#) (110-86-1)

potassium hydroxide (1310-58-3)

methylamine (74-89-5)

Hexafluoroacetone imine,
2-Propanimine, 1,1,1,3,3,3-hexafluoro- (1645-75-6)

Hexafluoroacetone (684-16-2)

triphenylphosphine imine

hexafluorothioacetone

perfluorodiethyl ketone

chloropentafluoroacetone (79-53-8)

N-phenyl-2,2-diaminohexafluoropropane

N-methyl imine (2053-29-4)

dichlorotetrafluoroacetone