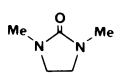
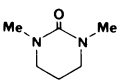
Dipolar, Aprotic Solvents

1,3-Dimethyl-2-imidazolidinone (DMEU) and **1,3-dimethyl-3,4,5,6-tetrahydro-2(1*H*)-pyrimidinone** (DMPU) are dipolar, aprotic, cyclic ureas that have recently been used as substitute solvents for the carcinogenic **hexamethylphosphoramide** (HMPA), $[(Me_2N)_3PO]$.[1]



DMEU

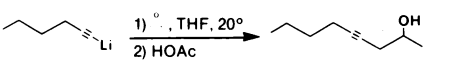


DMPU

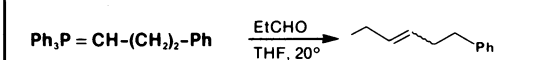
Both **DMEU** and **DMPU** are hygroscopic and miscible with water. They can be removed from solutions in hydrocarbons or ether by washing with water. Solvents such as chloroform and methylene chloride, however, retain **DMEU** and **DMPU** in the organic phase. **DMEU** and **DMPU** have high dielectric constants as well as high dipole moments which make them very good dissociating media.[2]

Professor D. Seebach has recently reported that, "For a carbonyl compound **DMPU** is remarkably unreactive: although a vigorous, exothermic reaction takes place when a hexane solution of butyllithium is added to a THF/**DMPU** mixture at -78°, only a slow reaction is noticed at -90°. If a more reactive substrate is present in solution, the **DMPU** cosolvent does not interfere: thus, at about -35° or below, butyllithium deprotonates diisopropylamine quantitatively in a (2:1) THF/-**DMPU** mixture, and the LDA formed is stable in this medium at temperatures between -78° and -35° for at least two to three hours. Of course, **DMPU** can also be added to the THF solution of a reagent generated under conventional metallation conditions, just prior to the reaction with an electrophile."[1]

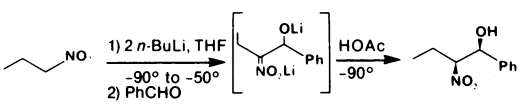
DMPU has been shown to exhibit the same effects as **HMPA** in oxirane openings with lithium acetylides, Wittig olefinations, double deprotonation of nitroalkanes, Michael additions of lithiodithiane to cyclohexenone, and selective generations of certain enolates.[1]



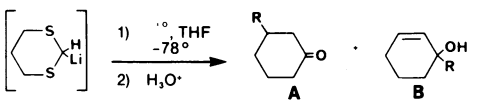
Cosolvent (% vol)		Yield (%)
HMPA	(17)	70
DMPU	(50)	59



Cosolvent (% vol)		Yield (%)	*Z*/*E*
HMPA	(35)	44	92 : 8
DMPU	(35)	39	93 : 7

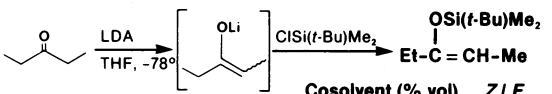


Cosolvent (% vol)		Yield (%)	*Threo* / *Erythro*
HMPA	(17)	78	9 : 1
DMPU	(25)	65	9 : 1



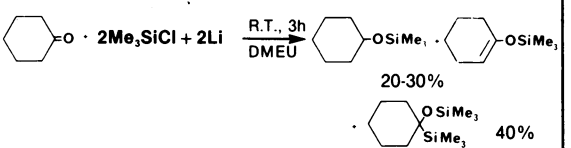
R = 1,3-dithian-2-yl

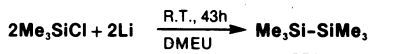
Cosolvent (% vol)		Yield (%)	A / B
HMPA	(50)	50 - 80	95 : 5
DMPU	(50)	70	92 : 8

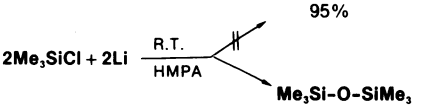


Cosolvent (% vol)		*Z*/*E*
HMPA	(23)	95 : 5
DMPU	(19)	94 : 6

Lastly, except for **HMPA**, common dipolar aprotic solvents such as DMF,[3] DMSO,[4] and tetramethylurea[5] are rather reactive towards strong bases and alkali metals. Being stable towards alkali metals, **DMEU** is a useful solvent in a variety of organometallic reactions.[6-8]







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