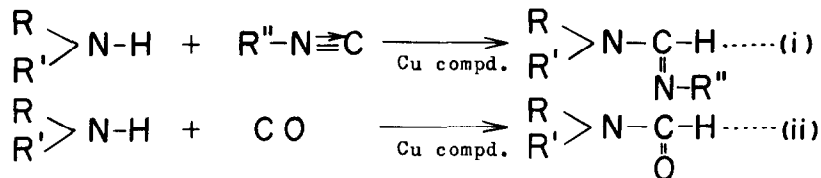


SYNTHETIC REACTION BY COMPLEX CATALYST III.
COPPER CATALYZED N-ALKYLATION OF AMINE WITH DIAZOALKANE

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(Received 16 September 1966)

In the preceding two communications (1,2), we have reported two reactions of amine by copper compound catalysts. The first is the reaction of amine with isocyanide(eq.(i)) and the second is that with carbon monoxide(eq.(ii)), where amidine and N-alkylformamide are formed, respectively.



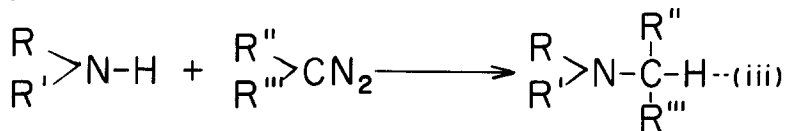
In both of these reactions, the carbon atoms bearing a lone pair of electrons are inserted between nitrogen and hydrogen of amine.

On the other hand, it is well known that copper and its compounds catalyze the decomposition of diazoalkanes. In relation to the mechanism of the diazoalkane reaction, coordination complexes of carbene to copper compound(3) (or an inverse ylid (4,5)) have been assumed.

The present work is the third of a series of the copper

catalyzed reactions of amine, in which the reactions of amine with diazomethane and with ethyl diazoacetate have been found.

In the presence of copper compound catalyst, the carbon atom of carbene generated by the decomposition of diazo compound is also inserted between nitrogen and hydrogen of amine.



The reaction of this type was once performed by Müller et al.(6), who employed boron fluoride and borofluoric acid as the catalyst.

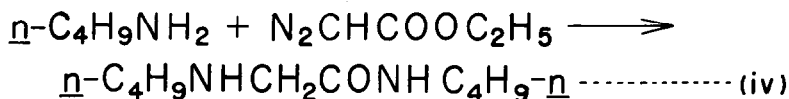
The difference in catalytic activity between the acid catalyst and the copper compound is seen in the reaction of piperidine with diazoacetate, i.e., the former does not catalyze the reaction of this combination, whereas the latter does.

To an ice-cold mixture of 17.9 g(0.21 mole) of piperidine and 1.57 g(0.017 mole) of cuprous cyanide, 7.98 g(0.07 mole) of ethyl diazoacetate was added dropwise with stirring at 5-10°C. After the addition, the reaction mixture was stirred for 5 hrs at 5-10°C. During the reaction, the color change of the reaction mixture from green to brown was observed. After the removal of the insoluble catalyst, the reaction mixture was distilled in vacuo to yield 8.64 g(72 %) of ethyl 1-piperidineacetate, b.p. 108-110°/20 mm Hg.

The reactions of amines with diazomethane and with diazoacetate are illustrated in Table 1.

In the reaction of n-butylamine and ethyl diazoacetate, the aminolysis of ester group as well as the insertion reaction

(iii) occurs to give the corresponding N-butylamine.








The products were identified by comparisons of its infra-red spectrum and the v.p.c. retention time with those of authentic samples.

An extensive study upon this reaction will be reported in the near future.

TABLE I

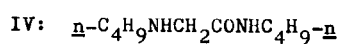
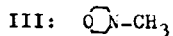
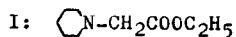
Copper Catalyzed Reaction of Amine with Diazoalkane^{a)}

Amine	Diazoalkane	Cu Catalyst	Products ^{c)}	Yield ^{d)} (%)
 NH	N ₂ CHCOOC ₂ H ₅	CuCN	I	72
 NH	N ₂ CHCOOC ₂ H ₅	CuCl	I	33
 NH	N ₂ CH ₂ ^{b)}	CuCN	II	32
 NH	N ₂ CH ₂ ^{b)}	CuCN	III	30
 NH	N ₂ CH ₂ ^{b)}	CuCl	III	25
<u>n</u> -C ₄ H ₉ NH ₂	N ₂ CHCOOC ₂ H ₅	CuCN	IV	46

a) Reaction conditions: 5-10°C, 5 hrs, molar ratio of amine/diazoalkane=3.0-4.0.

b) Diazomethane was employed as an ether solution.

c) Product



d) Based upon diazo compound.

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