

SYNTHESIS OF HETEROCYCLES FROM SULFUR-CONTAINING HETEROCUMULENES  
CYCLOADDITION OF CYCLOPROPENONE IN THE PRESENCE OF METAL CARBONYL

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Cycloaddition reaction of heterocumulenes in the presence of metal carbonyl provides a new route to heterocycles. We studied the reaction of ketenes with cyclopropenone in the presence of nickel tetracarbonyl, and found that 1:1 cycloadducts were formed in good yields. In this paper, we extend this reaction to sulfur-containing heterocumulenes such as N-sulfinyl amines, sulfur diimides, an isothiocyanate, carbonyl sulfide, and carbon disulfide.

1) Reaction with N-Sulfinyl Amines

Reactions of equimolar amounts of diphenyl cyclopropenone, aryl-N-sulfinyl amines, nickel tetracarbonyl gave N-aryl-3,4-diphenylpyrroline-2,5-diones as major products. In the case of N-sulfinyl cyclohexylamine, an isothiazolone derivative was the major product.

2) Reaction with Sulfur Diimides

Diphenyl sulfur diimide reacted with diphenylcyclopropenone in the presence of nickel tetracarbonyl to give an uracil and an isothiazolone. The yields of the components varied with reaction conditions. In the reaction with dialkyl sulfur diimides and iron pentacarbonyl, pyrroline derivatives were obtained instead of these products.

3) Reaction with an Isothiocyanate

Phenyl isothiocyanate and diphenylcyclopropenone were allowed to react by addition of nickel tetracarbonyl. Pyrroline-5-spiro-5'-thiophene and furan-5-spiro-5'-thiophene derivatives were obtained in addition to the 1:1 cycloadduct.

4) Reaction with Carbonyl Sulfide and Carbon Disulfide

In the reaction with carbonyl sulfide, only the 1:1 cycloadduct was isolated. On the other hand, the corresponding spiro heterocyclic compound was formed in the reaction with carbon disulfide.