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The Catalytic Oxidation of Phenanthrene*

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SUMMARY

The main products of the vapour-phase oxidation of phenanthrene are phthalic anhydride, 2-hydroxydiphenyl-2'-carboxylic acid lactone and 1:2-naphthalic anhydride. Conditions may be varied to give the optimum yield of a particular product, which attains at least 56% for phthalic anhydride or 4.5% for the lactone. Smaller quantities of other compounds have been isolated which provide evidence of the course of the oxidation. A feature of the laboratory-scale process described is the use of a fluidised catalyst. The catalyst used was vanadium pentoxide with and without potassium sulphate on a silica support.

(1) Introduction

The chemical utilisation of the coal-tar hydrocarbons boiling at temperatures above 270°C has always been very restricted in spite of the large quantities potentially available in creosote and anthracene oils. Phenanthrene, which distils in the anthracene oil range, is, next to naphthalene, the most abundant single constituent in coal tar, and its conversion into oxygen-containing compounds, particularly acids by catalytic oxidation with air, would provide a source of chemical intermediates of great value, either known or potential, for the manufacture of alkyd resins, plasticisers and coating materials.

It is known¹ that phthalic anhydride may be obtained in good yield by the catalytic oxidation of phenanthrene using a pure vanadium pentoxide catalyst in a fixed bed. This has been confirmed (using a fluidised catalyst) by the author, and the published information supplemented by some details of the necessary reaction conditions and of the application of the fluidised catalyst technique to the preparation of phthalic anhydride. The experiments to be described,

*Part of the work described here is the subject of Patent Application No. 1913/52 and applications in the U.S.A. and Germany are pending.