The electrophilic substitution reaction between benzene and nitric acid

Benzene is treated with a mixture of concentrated nitric acid and concentrated sulfuric acid at a temperature not exceeding 50°C. As temperature increases there is a greater chance of getting more than one nitro group, \(-\text{NO}_2\), substituted onto the ring. Nitrobenzene is formed:

\[
\text{C}_6\text{H}_6 + \text{HNO}_3 \rightarrow \text{C}_6\text{H}_5\text{NO}_2 + \text{H}_2\text{O}
\]

or:

\[
\text{C}_6\text{H}_6 + \text{HNO}_3 \rightarrow \text{C}_6\text{H}_5\text{NO}_2 + \text{H}_2\text{O}
\]

The concentrated sulfuric acid is acting as a catalyst.

The formation of the electrophile

The electrophile is the "nitronium ion" or the "nitryl cation", \((\text{NO}_2^+)\). This is formed by reaction between the nitric acid and the sulphuric acid.

\[
\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ 2\text{HSO}_4^- + \text{H}_3\text{O}^+
\]

The electrophilic substitution mechanism

Stage one

Stage two
Contributors

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