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The formation of benzene during the thermal decomposition of hydrocarbons has been attributed to the reactions of $C_3H_3^+$ with low molecular weight hydrocarbons. Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR) permits direct observation of the gas phase reactions of $C_3H_3^+$ with conjugated dienes. Two forms of $C_3H_3^+$ are observed: *i)* The propargyl isomer, which reacts with dienes to produce a phenyl cation, and *ii)* an unreactive cyclopropenyl isomer. Deuterium labeling experiments were utilized to postulate a mechanism for the reaction. An ionic model for the gas phase formation of benzene based on a reactive propargyl cation will be presented.

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