

- hydrogenation, dehydrogenation, and oxidation. References furnish a key to literature of catalysis.
241. OSTROMISLENSKI, I., AND BURSHANADSE, J. [Über die pyrogene Zersetzung der Naphtha in Gegenwart von Katalysatoren. 1. Über den Bildungsmechanismus des Benzols bei der pyrogenen Zersetzung der Naphtha.] Jour. Russ. Phys. Chem. Gesell., Bd. 42, 1910, pp. 195-207; Chem. Zentralb., Jahrg. 81, Bd. 1, May 11, 1910, pp. 1711-1712; Jour. Soc. Chem. Ind., vol. 29, June 15, 1910, p. 682. Aromatic hydrocarbons are formed at high temperatures from petroleum by polymerization of acetylene, and use of catalyzers increases output. After passing petroleum vapor through a combustion tube at 700° C., containing a spiral of iron wire gauze, products contained 10.9 per cent of benzene compared with 7.5 per cent when no iron gauze was used. Using nickel instead of iron no benzene was obtained. Part 2. Description of hydrocarbons into carbon and hydrogen by the contact process; use of nickel and nickel oxides.
242. ROSENFELD, J. Zerfallsprodukte des Petroleums. Oesterr. Chem. tech. Ztg., Bd. 27, 1909, p. 1; Engler-Höfer, Das Erdöl, Bd. 1, 1913, p. 591. Describes the hydrocarbons found in tar obtained by passing petroleum through a red-hot tube. Benzene was found in first fraction under 200°. Coke or copper used as a catalyzer increased output.
243. SABATIER, PAUL. Hydrogénations et déshydrogénations par catalyse. Ber. Deut. chem. Gesell., Jahrg. 44, Bd. 2, 1911, pp. 1984-2001. Methods devised by Sabatier and his students. General action of metals used as catalyzers, and their special action on many hydrocarbons.
244. SABATIER, PAUL, AND SENDERENS, J. B. Action de divers métaux divisés, platine, cobalt, fer sur l'acétylène et sur l'éthylène; Compt. rend., t. 131, July 25, 1900, pp. 267-270; Jour. Chem. Soc., vol. 78, pt. 1, 1900, p. 534. Above 200°, with iron as catalyzer; chief products in addition to hydrogen and carbon were olefins and benzene. Use of cobalt resulted in less benzene.
245. ——— Action du nickel réduit sur l'acétylène. Compt. rend., t. 131, July 16, 1900, pp. 187-190; Jour. Chem. Soc., vol. 78, pt. 1, 1900, p. 471. A rapid current of acetylene passed over reduced nickel at a temperature above 180° gave 10.3 per cent of benzene and its homologues, 51.4 per cent of hydrogen, 36.3 per cent of ethane, 2 per cent of ethylene, and traces of acetylene. The liquid product was a mixture of aromatic and unsaturated hydrocarbons boiling between 50° and 180° C.
246. ——— Hydrogénation de l'acétylène en présence du nickel. Compt. rend., t. 128, May 8, 1899, pp. 1173-1176; Jour. Chem. Soc., vol. 76, 1899, p. 555. Mixtures of acetylene and hydrogen were passed over finely divided nickel. Main reaction was formation of ethane; but as proportion of acetylene in original mixture was increased, amount of benzene hydrocarbons in product also increased. Iron, cobalt, and copper acted similarly.
247. ——— Hydrogénation de l'acétylène et de l'éthylène en présence du platine divisé. Compt. rend., t. 131, July 2, 1900, pp. 40-42; Jour. Chem. Soc., vol. 78, pt. 1, 1900, p. 471. At 180° in presence of platinum black, condensation of products yields liquid hydrocarbons.
248. ——— Nouvelles méthodes générales d'hydrogénation. Ann. chim. phys., ser. 8, t. 4, 1905, pp. 319-480. Catalyzers, as finely divided nickel, were used. At 16° in a tube 30 cm. long benzene vapor is hydrogenized by nickel to cyclohexane. Time of reaction a factor (p. 360). At 270° to 280° cyclohexane in contact with finely divided nickel decomposes into benzene (p. 363). Reactions with homologues of benzene, using other catalysts, follow (p. 364).

249. SALZMANN, M., AND WICHELHAUS, H. Ueber die Herstellung von Benzol aus Braunkohlentheeröl. Ber. Deut. chem. Gesell., Jahrg. 11, Bd. 2, 1878, pp. 1431-1434. Oil was passed over pumice stone, wood and animal carbon, or platinized asbestos in a tube heated to redness. Results are tabulated.
250. SMITH, CLARENCE, AND LEWCOCK, WILLIAM. Pyrogenic decompositions—benzene. Jour. Chem. Soc., vol. 101, pt. 2, 1912, pp. 1453-1459. Describes the influence of temperature and continued heat on formation of diphenyl from benzene. Benzene was passed through an iron tube at 600° to 800° C., and results with BaO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, ZnO, and Pb<sub>3</sub>O<sub>4</sub> as catalyzer are tabulated. Yield of diphenyl was 10 to 59 per cent.
251. UBBELOHDE, LEO, WORONIN, S., AND ST. PHILIPPIDE, —. Ueber die Einwirkung von Katalysatoren auf Erdöl. Petroleum, Jahrg. 7, Oct. 4, 1911, Jan 3, Aug. 21, 1912, pp. 9-13, 334-339, 1233-1238; Chem. Abs., vol. 7, pt. 1, Jan. 10, 1913, pp. 246-247. Porous earthenware on which nickel had been reduced in metallic form was impregnated with petroleum oil, and heated in a current of purified nitrogen or hydrogen at regulated temperatures from 180° to 500°. Various proportions of hydrogen, methane, and ethane were produced. The effect of fuller's earth, unburned kaolin, ignited alumina, and nickel upon petroleum at temperatures of 200° to 400° was studied, and a table of results and curves given, pp. 1234-1238.
252. VOHL, H. Ueber die Versetzung der Schweren Mineralöle aus Braunkohlen, Torf, bituminösen Schiefen, Petroleum, und zur Erzeugung leichter (wasserstoffreicher) Beleuchtungsöle. Dingl. poly. Jour., Bd. 177, 1865, pp. 58-76. Heavy oil was distilled with concentrated sulphuric acid, with sodium hydroxide, and over glowing lime. The vapors were cracked in iron tubes filled with iron filings or limestone.
253. ZELINSKY, N. D. Über Dehydrogenisation durch Katalyse. Ber. Deut. chem. Gesell., Jahrg. 44, Bd. 3, 1911, pp. 3121-3125; Chem. Zentralb., Jahrg. 82, Bd. 4, Dec. 13, 1911, p. 1794. Hexamethylene hydrocarbons are easily dehydrogenated by passing them over palladium black at 300°. Dehydrogenation begins at 170° and goes on energetically at 200°. Benzol and toluol are obtained. Copper, silver, and magnesium are inactive as catalyzers.
254. ——— Über die selektive Dehydrogenisations-Katalyse. Ber. Deut. chem. Gesell., Jahrg. 45, Bd. 3, 1912, pp. 3678-3682; Chem. Abs., vol. 7, pt. 2, July 10, 1913, p. 2224. Hexamethylene hydrocarbons are readily dehydrogenated in the presence of platinum or palladium at 300°, but pentamethylene derivatives remain unchanged below 300°.

CRACKING, ACTION OF HEAT OR OF HEAT AND PRESSURE, ON  
PETROLEUM.

255. ARMSTRONG, H. E. On the manufacture of gas from oil; Preliminary note on certain by-products of the manufacture of gas from oil by the Pintsch process in relation to the question of the conditions under which benzenoid hydrocarbons are formed. Jour. Soc. Chem. Ind., vol. 3, Sept. 29, 1884, pp. 462-468. Remarks on chemical products formed by cracking oil. Naphthenes and olefins from ethylene to monylene, and crotonylene were among products.
256. BJERREGAARD, A. P. Studies on the pressure distillation of petroleum hydrocarbons. Jour. Ind. Eng. Chem., vol. 7, July, 1915, pp. 573-577; Pet. Rev., vol. 33, Aug. 14, 1915, p. 126. An investigation for developing on a commercial scale a process for making light-gravity hydrocarbons from the heavier fractions of petroleum. Oil is forced through a coil under pressure of 2,000 pounds per square inch.