# CURRENT WORK

Because a more rugged and durable catalyst is desirable for the oil-recycle process, various forms of massive iron are being investigated (*10*). To prepare this type of catalyst some form of steel or iron is partly oxidized with steam and then reduced with hydrogen to provide an active surface with an inert core consisting primarily of massive iron. Both steel shot and lathe turnings have been tested. With steel shot an expanded bed must be maintained to avoid cementation, but lathe turnings may be used in a fixed bed because the percentage of voids is quite high, averaging 80 to 90 compared with about 50 percent for a granular bed. Thus, a rapid flow of coolant oil may be maintained through the turnings without the danger of catalyst carryover, as movement of the catalyst is not required. Much greater catalyst stability and life have been attained with massive iron. Operating temperatures up to 290° C. have been employed without serious catalyst disintegration and with considerably longer catalyst life than was possible with the granular catalyst. Deposition of carbon and oxidation of the catalyst remain problems, especially at the higher temperatures. The present program of investigation is directed toward increasing the stability of the catalyst at higher temperatures of synthesis where much greater yields of gasoline and higher synthesis-gas throughputs can be obtained.

# GLOSSARY OF TERMS

**Catalyst age** — Length of time that the catalyst has been subjected to synthesis after the original pretreatment, usually expressed in hours.

**Feed-gas ratio** — Volumetric ratio of hydrogen to carbon monoxide in feed gas, dimensionless.

**Usage ratio** — Volumetric ratio of hydrogen consumed to carbon monoxide consumed during synthesis, dimensionless.

**Gas-recycle ratio** — Volumetric ratio of recycled tail gas to fresh feed gas, dimensionless.

**Hourly space velocity of gas, S. V. H. (in tables)** — Volumes (S. T. P.) of gas per hour per volume of catalyst, cu. ft. per hr.-cu. ft. catalyst or $m.^3$ per hr.-$m.^3$ catalyst. (S. T. P.) refers to standard temperature and pressure of 0° C. and 760 mm. Hg.

**Contraction, percent** — $\frac{[\text{Feed-gas volume (S. T. P.)}]-[\text{tail-gas volume (S. T. P.)}]}{[\text{feed-gas volume (S. T. P.)}]}\times 100$, dimensionless.

**$CO_2$-free contraction, percent** — $\frac{[\text{Feed-gas volume (S. T. P.)}]-[\text{$CO_2$-free tail gas volume (S. T. P.)}]}{[\text{feed-gas volume (S. T. P.)}]}\times 100$, dimensionless. Contraction is indicative of extent of conversion of synthesis gas.

**Conversion, percent** — Extent of conversion of raw material, such as $H_2+CO$:

$$\frac{(H_2+CO)_{in}-(H_2+CO)_{out}}{(H_2+CO)_{in}}\times 100,$$ dimensionless.

**Catalyst activity** — Qualitative relationship between extent of conversion and operating temperature at any time during the experiment, usually judged by the temperature required for 70-percent conversion at a given space velocity.

**Yield** — Weight of any component or components per unit volume of feed or converted gas, lb. component per cu. ft. gas, or gm. component per $m.^3$ gas.

**Specific yield** — Yield of given product per $m.^3$ of converted synthesis gas, gm. per $m.^3$ converted ($H_2+CO$).

**Gas yield** — Sum of the yields of $CH_4$, $C_2H_4$, and $C_2H_6$; (gm. $C_1+C_2$ per $m.^3$).

**Space-time yield** — Weight of $C_3+$ hydrocarbons produced per unit time per volume of catalyst, kg. per hr.-$m.^3$ of catalyst or kg. per day-$m.^3$ of catalyst or lb. per hr.-cu. ft. of catalyst. Occasionally, space-time yield will be based on converter volume, which will be so specified.

**Space weight yield** — Volume of gas converted per hour per unit weight of metal, cu. ft. (S. T. P.) per hr.-lb. metal; not commonly expressed in metric units.

**Catalyst productivity** — Weight of $C_3-$ hydrocarbons produced per weight of catalyst during its entire life, lb. $C_3+$ per lb. Fe, or kg. $C_3+$ per kg. Fe.

**Classification of products:** Boiling range at atmospheric pressure, °C.:

- Gasoline ($C_3+$) — <204.
- Diesel oil — 204–316.
- Heavy distillate — 316–450.
- Wax — >450.

**Number of experiment** — All experiments bearing a given Arabic number were conducted with the same catalyst charge. Letter designation following numbers refers to individual periods of operation. For example, experiments 2–A and 2–F refer to the first and sixth operating periods employing the same catalyst charge placed under test during this program.

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