

Report 7

Development of Catalysts for the Direct Synthesis
of Liquid Hydrocarbon Fuels (LHF) From Syngas

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BASIC CONCEPTS

- AT LEAST TWO STEPS:
 - 1) FORM C-C BONDS FROM SYNGAS.
 - 2) BUILD LARGE HYDROCARBON MOLECULES.

- FORMATION OF C-C BONDS REQUIRES TRANSITION METAL (OR COMPOUND) AS CATALYST - MC.

- THE COURSE OF MOLECULE BUILDING (ISO OR NORMAL PARAFFINS, OLEFINS, AROMATICS) WILL BE EFFECTED BY MICROPOROUS CRYSTALS CALLED MOLECULAR SIEVES - SSC.

- PLAN: BY PROPER CHOICE OF MC, SSC, P, T AND T, HIGH YIELDS OF LHF CAN BE ATTAINED.

PROGRAM

- TASK 1 EVALUATE VARIETY OF SHAPE SELECTIVE
 CATALYST COMPONENTS FOR MAKING LIQUID
 HC FUELS.
- TASK 2 MAKE AND TEST FINISHED CATALYSTS FOR
 SYNGAS + LHF.
- TASK 3 STUDY SURFACE CHEMISTRY AND TRANSIENT
 SPECIES.
- TASK 4 REPORT

TASK 1

EVALUATE VARIETY OF SSC'S

- 1.1 DEVELOP CATALYST TEST PACKAGE
BUILD TEST STATIONS - BERTY TYPE
ESTABLISH ANALYTICAL METHODS
DEVELOP STANDARD TEST - P, T, T
- 1.2 TRY SSC'S WITH DIFFERENT ACID STRENGTHS AND
ACID CONCENTRATIONS.
- 1.3 TRY VARIETY OF CATEGORIES OF SSC'S AND EXAMINE EFFECTS.
- 1.4 STUDY EFFECT OF POLARITY: HYDROPHILIC VS. HYDROPHOBIC.
- 1.5 LOOK AT TECHNIQUES FOR METAL-LOADING SSC'S.
- 1.6 OPTIMIZE AND ITERATE.

TASK 2
MAKE AND TEST FINISHED CATALYSTS FOR
SYNGAS + LHF

- 2.1 MODIFY TEST PACKAGE
 - DEVELOP PROCEDURES FOR ACTIVATING CATALYSTS
 - DEVELOP NEW STANDARD CONDITIONS - P, T, τ
- 2.2 TRY PHYSICAL MIXTURES OF MC (TRANSITION, PRECIOUS), AND SSC COMPONENTS.
- 2.3 EVALUATE OTHER METHODS OF INCORPORATING MC ONTO SSC.
- 2.4 VARY MC PARTICLE SIZE.
- 2.5 TRY PROMOTERS AND MODIFIERS.
- 2.6 OPTIMIZE WATER-SHIFT ACTIVITY.
- 2.7 OPTIMIZE LHF CATALYST PERFORMANCE.

TASK 3

CATALYST SURFACE CHARACTERIZATION AND STUDIES
OF REACTION INTERMEDIATES

- BUILD VACUUM-PRESSURE APPARATUS FOR SURFACE STUDIES.
- CHARACTERIZE SURFACES FORMED BY MC AND SSC COMPONENTS DURING HYDROGENATION OF CO.
- STUDY REACTION INTERMEDIATES FORMED BY THESE SURFACES.
- CORRELATE NATURE OF SURFACES AND INTERMEDIATES TO OBTAIN CLUES TO REACTION MECHANISM.

CURRENT STATUS AND PROSPECTS

STATUS

- EQUIPMENT BEING ORDERED
- LAB MODIFICATIONS
- ANALYTICAL WORK

PROSPECTS

- MUCH DATA
- IMPROVED UNDERSTANDING OF ROLE OF MC AND SSC
IN HYDROCARBON SYNTHESIS.
- MAYBE - PROMISING PROCESS FOR MAKING
TURBINE AND DIESEL FUEL.