COPY

STATUS REVIEW OF FISCHER-TROPSCH SLURRY REACTOR CATALYST / WAX SEPARATION TECHNIQUES

Prepared for
U.S. Department of Energy
Pittsburgh Energy Technology Center

Prepared by
P. Z. Zhou & R.D. Srivastava
Burns and Roe Services Corporation

February 1991

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their support contractors, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, mark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

TABLE OF CONTENTS

		Page
	EXECUTIVE SUMMARY	1
I.	INTRODUCTION	5
1	. Background	5
2	Scope of Report	6
П.	RELATED PROPERTIES OF WAX-SLURRIES FROM	v
	FISCHER-TROPSCH REACTORS	7
1.	. Reactor Wax	7
2.	. Catalyst Particles	ģ
	BASIC REQUIREMENTS OF SLURRY CATALYST/WAX	
	SEPARATION	11
IV.	CATALYST/WAX SEPARATION INSIDE	11
	THE SLURRY REACTOR	13
V.	VACUUM DISTILLATION	15
VI.	THERMAL CRACKING OF VACUUM BOTTOMS	16
VII.	SEDIMENTATION	17
۷Ш.	FILTRATION	19
	CENTRIFUGATION	21
1.	. Hydroclones Centrifuges	21
2.	. Centrifuges	21
	SOLVENT-ASSISTED CATALYST/WAX SEPARATION	23
XI,	MAGNETIC SEPARATION	24
XII.	0.2201.2201.200 1.2011.QDQ	28
ХШ.	COMMENTS	29
XIV.	RESEARCH RECOMMENDATIONS	31
	REFERENCES	33

LIST OF TABLES

		page
TABLE 1.	Composition of Fischer-Tropsch Reactor-Waxes	- 37
TABLE 2.	Composition of Fischer-Tropsch Waxes	- 38
TABLE 3.	Physical Properties of F-T Slurry Bubble-Column	
	Mediums	- 39
TABLE 4.	Physical Properties of F-T Waxes	- 40
	Properties of Fischer-Tropsch Waxes	
TABLE 6.	Thermal Cracking of Reactor-Wax Vacuum Bottoms	42
	Efficiency of Sedimentation with Various Types	
	of Insert	- 43
TABLE 8.	Magnetic Separation of Catalyst Fines from Slurry	
	Bubble Column Wax	- 44

LIST OF FIGURES

		page
FIGURE 1.	FIMS Spectrum of F-T Slurry Reactor Wax	46
FIGURE 2.	Carbon Number Distribution of F-T Waxes	47
FIGURE 3.	Particles Size Distribution of Fresh F-T Catalyst	48
FIGURE 4.	Bureau of Mines Pilot-Scale F-T Reactor	49
FIGURE 5.	Bureau of Mines Modified F-T Process	50
FIGURE 6.	Diagrammatic Arrangement of a Hydrocarbon	
	Synthesis Plant	- 51
FIGURE 7.	Sedimentation Results	52
FIGURE 8.	Schematic Diagram of a Continuous Settling System	:
	for Catalyst/Wax Separation	53
FIGURE 9.	Photographs of Slurry Samples	54
FIGURE 10.	Flow Diagram of Rheinpreussen-Koppers	•
	Demonstration Plant	55
FIGURE 11.	Generation of High Magnetic Field Gradient	56
FIGURE 12.	HGMS Separation of F-T Catalyst from Slurry Wax	57
FIGURE 13.	Superconducting Magnetic Separator	58