

科技随笔

—— 郭慕孙科研手稿选集

上集

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我十九岁进大学上化学试验课时，老师要求我们每人要有一本笔记本，记录所有试验现象和数据以及个人的设想。从此我养成了“随想随记”的习惯。我三十六岁（1956年）回国后，很欣赏我们国家提倡“一步一个脚印”的工作作风。于是，40多年来，我积累了不少手稿。明年我即将资深，我没有什麼具有物质价值的东西留给后人，不如将这些手稿略加整理，汇集成本，供人参考。

我选了67篇原始手稿（约500页），未加改写，按时序排列。这些手稿始于文革后的“第二个科学春天”，直至今天。第一篇是在伊朗举行的国际化工会议的手写稿的初稿的第一页，最后一篇是我从事的业余爱好，“几何动艺”的最近设计。

整理汇集的工作从今天开始。

郭慕孙

1999-7-16

按手稿档案号编排

Individual Files 手稿

(I = individual files) 上集

1/1 = 10

	73-4-1	i Particulate Fluidization in Chemical Metallurgy	2 pp
	76-6-28	i #3A 流态化烘干机	1
	76-7-19	i 应城 15,000t/y 石膏炉: 热料入炉	4
x	82-2-12	i Generalized Fluidization of Polydisperse Systems - Tentative Modeling of Particle Concentration Profile	9
	83-3-12	i 菱铁矿的煅烧	2
	86-6-5	i Iron Oxide Reducer with <i>in situ</i> CO Generation	4
	95-1-25	i 煤的拨头工艺	4
	97-2-26	i Peristaltic Feeder - Sequencing, Pressure Gradient and Venting Rate	4
	97-2-6	i Peristaltic Feeder - Hardware	2
	99-5-25	i How Dense Could CFB Get to ?	9
	99-1-23	i Straight Line Twister	2

硫酸纸 手稿

(t = tracing paper) 上集

25/1 = 24

	74-3-7	t 气控多层流态化床	12 pp
	75-7-15	t 铁矿粉载流还原反应器	9
	75-7-23	t 顺流串联反应器	14
	75-9-	t 张庄铁矿氢还原反应器设计 2. 反应系统选择	20
	75-9-21	t 双粒度广义流态化	20
	75-10-11	t 微分洗涤器的数学模拟	6
	76-3-8	t 快速流态化 一些实验数据的初步分析	14
	76-3-31	t 攀枝花太和铁精矿流态化氢还原反应器设计	18
	76-4-17	t 张庄铁矿氢还原反应器设计 3. 沧州 100kg/d 炉试验数据处理	8
	76-4-21	t 万吨气体炼铁厂方案建议	3
	76-7-1	t 天然气流态化还原 40 矿: 还原-造气-动力综合流程	10
	76-8-5	t 沧州气体炼铁 3000t/y 配套工程: H ₂ -N ₂ 自循环流程	4
x	76-8-21	t 三室: 工作、学术交流和汇报	1
	76-10-1	t 快速流态化 2. 一个数学模型	9
	76-10-14	t 顺流粉矿预热炉	12
	77-1-26	t 磁场料阀	4
	77-2-6	t 焙烧红土矿时镍铁还原度之间的关系	4
	77-2-7	t 流态化热载体炼铁	7
	77-2-13	t 浓相输送溢流管	22
	78-6-24	t 变压溢流管	7
	79-1-16	t 快速流态化 3. 数学模型的试验验证	6
	79-8-3	t The Jigged Reducer	4
	80-2-14	t GENERALIZED FLUIDIZATION III. A Tentative Treatment of Nonideality for Gas-Solid Systems	21
	81-1-21	t MULTI-STAGED FLUIDIZED BEDS - L/S Fill-and-Dump Type	8
	81-11-13	t The Jigged Reducer II	8

Miscellaneous Ideas 手稿

(m=miscellaneous) 下集

25-2 = 23

x	57-1-10	m Physical Properties of Fluidizing Media	1 pp
	undated	m Writing Scientific English	5
	80-3-1	m 合纤厂流态化解吸	2
	80-11-17	m 用分步结晶法从包头炉渣中富集稀土金属	1
	81-1-13	m Cocurrent Multistage Fluidized Bed	10
x	undated	m Memo to Zhang Chuangen	1
	81-6-3	m 向科学院提出意见 6 条	8
	83-11-14	m From Concept to Technology	11
	85-10-13	m Moving-Bed Filter-Washer MBFW	2
	88-1-14	m Fluidized Hospital Bed	6
	88-2-3	m FBF Roaster G	7
	88-3-27	m Integral CFB Reactor	4
	88-4-6	m Integral CFB Reactor II	3
	88-6-27	m Peristaltic Solids Feeder	1
	88-6-29	m Coal-Gas-Mixture CGM	2
	88-7-19	m Response of LSFB to Step Changes	5
	88-11-28	m Regenerative Solid-Adsorbent Process for Desulfuring Flue Gas	2
	89-1-6	m Proposed Topics for Basic Study in Energy Science	1
	89-12-9	m Particulated Gas Fluidization	8
	90-1-13	m CFB Pyrite Roaster	1
	90-8-3	m Integral CFB Reactor III	2
	90-10-30	m Proposed Designation for Fluid-Particle Heterogeneity	3
	91-10-11	m Tailoring Chemical Engineering Research to China's Needs	8
	93-10-10	m Rice Cleaner	3
	93-11-13	m Thermal-Carrier-Based Processes for Comprehensive Utilization of China's Unique Resources	3

Ring Notebook 手稿

(r=ring notebook) 下集

	79-2-18	r 关于 501 厂煅烧 Al_2O_3 的一些意见	1 pp
	80-11-5	r 三级劣煤燃烧器	3
	80-11-30	r 磁化焙烧: 快速床 + 间接加热	7
	82-5-1	r A Pneumatic Solids Extractor	4
	82-10-16	r High-Temperature Granular-Bed Filter	6
	82-10-30	r Distributor Design for the Cocurrent Multistage Shallow Fluidized Beds	5
	82-11-4	r Experiments on the L/S Magnetized Fluid Bed	5
	82-11-26	r Impact-Stabilized Fluid-Bed Distributor	3
	82-12-13	r Reactor Analysis for Fast Fluidization - a tentative formulation of the problem	7
	83-3-8	r The Jigged Reducer III	5

科技随想 手稿 (时序)

(i=individual; t=tracing paper; m=miscellaneous; r=ring notebook)

	73-4-1	i Particulate Fluidization in Chemical Metallurgy	2 pp
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	75-7-23	t 顺流串联反应器	14
	75-9-	t 张庄铁矿氢还原反应器设计 2.反应系统选择	20
	75-9-21	t 双粒度广义流态化	20
	75-10-11	t 微分洗涤器的数学模拟	6
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	76-4-21	t 万吨气体炼铁厂方案建议	3
	76-6-28	i #3A 流态化烘干机	1
	76-7-1	t 天然气流态化还原 40 矿: 还原-造气-动力综合流程	10
	76-7-19	i 应城 15,000t/y 石膏炉: 热料入炉	4
	76-8-5	t 沧州气体炼铁: 3000t/y 配套工程: H ₂ -N ₂ 自循环流程	4
	76-10-1	t 快速流态化 2.一个数学模型	9
	76-10-14	t 顺流粉矿预热炉	12
	77-1-26	t 磁场料阀	4
20	77-2-6	t 焙烧红土矿时镍铁还原度之间的关系	4
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	80-3-1	m 合纤厂流态化解吸	2
	80-11-5	r 三级贫煤燃烧器	3
30	80-11-17	m 用分步结晶法从包头炉渣中富集稀土金属	1
	80-11-30	r 磁化焙烧: 快速床+间接还热	7
	81-1-13	m Cocurrent Multistage Fluidized Bed	10
	81-1-21	t MULTI-STAGED FLUIDIZED BEDS - L/S Fill-and-Dump Type	8
	81-6-3	m 向科学院提出意见 6 条	8
	81-11-13	t The Jigged Reducer II	8
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	83-3-12	i 菱镁矿的煅烧	2
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	85-10-13	m Moving-Bed Filter-Washer MBFW	2

	86 - 6 - 5	i Iron Oxide Reducer with <i>in situ</i> CO Generation	4
	88 - 1 - 14	m Fluidized Hospital Bed	6
	88 - 2 - 3	m FBF Roaster G	7
	88 - 3 - 27	m Integral CFB Reactor	4
10	88 - 4 - 6	m Integral CFB Reactor II	3
	88 - 6 - 27	m Peristaltic Solids Feeder	1
	88 - 6 - 29	m Coal-Gas-Mixture CGM	2
	88 - 7 - 19	m Response of LSFB to Step Changes	5
	88 - 11 - 28	m Regenerative Solid-Adsorbent Process for Desulfuring Flue Gas	2
	89 - 1 - 6	m Proposed Topics for Basic Study in Energy Science	1
	89 - 12 - 9	m Particulated Gas Fluidization	8
	90 - 1 - 13	m CFB Pyrite Roaster	1
	90 - 8 - 3	m Integral CFB Reactor III	2
	90 - 10 - 30	m Proposed Designation for Fluid-Particle Heterogeneity	3
10	91 - 10 - 11	m Tailoring Chemical Engineering Research to China's Needs	8
	93 - 10 - 10	m Rice Cleaner	3
	93 - 11 - 13	m Thermal-Carrier-Based Processes for Comprehensive Utilization of China's Unique Resources	3
	95 - 1 - 25	i 煤的拔头工艺	4
	97 - 2 - 26	i Peristaltic Feeder - Sequencing, Pressure Gradient and Venting Rate	4
	97 - 2 - 6	i Peristaltic Feeder -- Hardware	2
	99 - 5 - 25	i How Dense Could CFB Get to ?	9
17	99 - 1 - 23	i Straight Line Twister	2

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概言

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99-1-23	Straight Line Twister	2

工艺

75-9-	t 张庄铁矿氧还原反应器设计 2. 反应系统选择	20
76-4-21	t 万吨气体炼铁厂方案建议	3
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95-1-25	煤的拔头工艺	4

设备

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93-10-10	m Rice Cleaner	3
97-2-26	Peristaltic Feeder - Sequencing, Pressure Gradient and Venting Rate	4
97-2-6	Peristaltic Feeder - Hardware	2

基础

75-9-21	t 双粒度广义流态化	20
75-10-11	t 微分洗涤器的数学模拟	6
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99-5-25	How Dense Could CFB Get to ?	9

文革后期，化工部要选一篇论文参加在伊朗举行的国际化工会议。选择始于对科研院所的走访、微稿，终于在河北琢县的试讲、评选会议。我的文章“化工冶金中的散式流态化”被选中。微稿没有规定写什么怎么写，所以还是以“随笔”开始。这是在琢县写成的英译首段。

Continuous Fluidization in Chemical Metallurgy

78-2-1

Abstract

On the basis of particulate fluidization, the present paper delineates the characteristics of an idealized fluidized system of complete homogeneity, and proposes, ther, analogous to an ideal gas, the simple relationships existing among the variables of this idealized system, can be utilized as convenient tools in the analysis of many ~~chemical~~ engineering problems, as illustrated by ^{as} examples taken from chemical metallurgy, such as generalized fluidization, ^{stage fluidizing} ~~stage fluidizing~~ leaching; the operation of conical fluidized beds, and ^{size} ~~size~~ ^{particle} ~~particle~~ segregation in ^{fluidized} ~~fluidized~~ ^{beds} ~~fluidization~~, to illustrate how such an approach can provide simple explanations of certain aspects of complex phenomena and offer suggestions in design methods as well as process development.

这是在伊郎散发的这篇文章的封面。这篇文章将我带入了我国“第二个科学春天”。回国后，本文转载于中国科学 1973(3), 298, 及其英文版 *Scientia Sinica* 16(3), 407 (1973)。

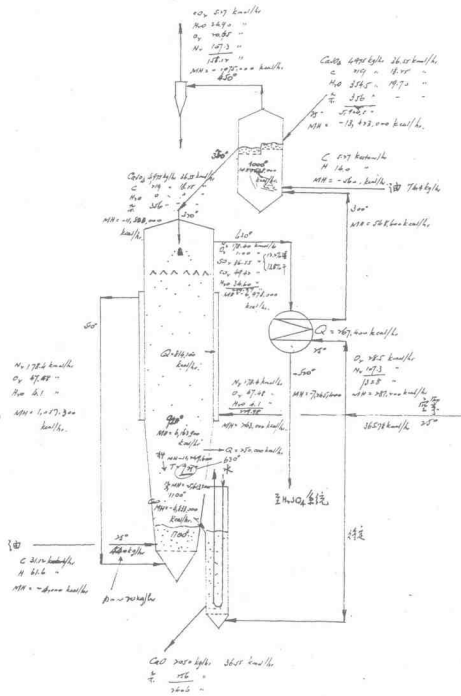
PARTICULATE FLUIDIZATION IN CHEMICAL METALLURGY

Mooson Kwauk (郭慕孙)

Institute of Chemical Metallurgy
Academia Sinica

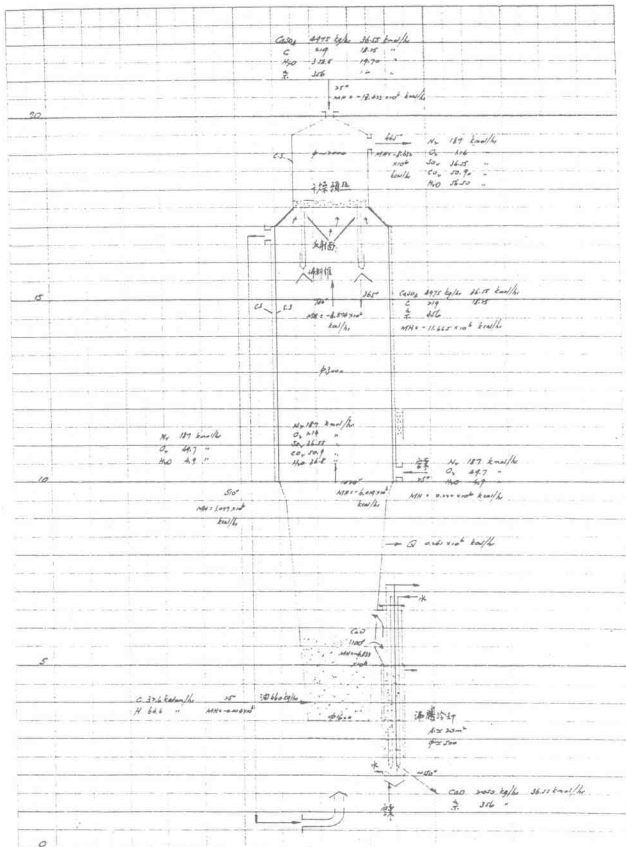
April 6, 1973

应城 15,000 T/Y 石膏炉: 熟料入炉



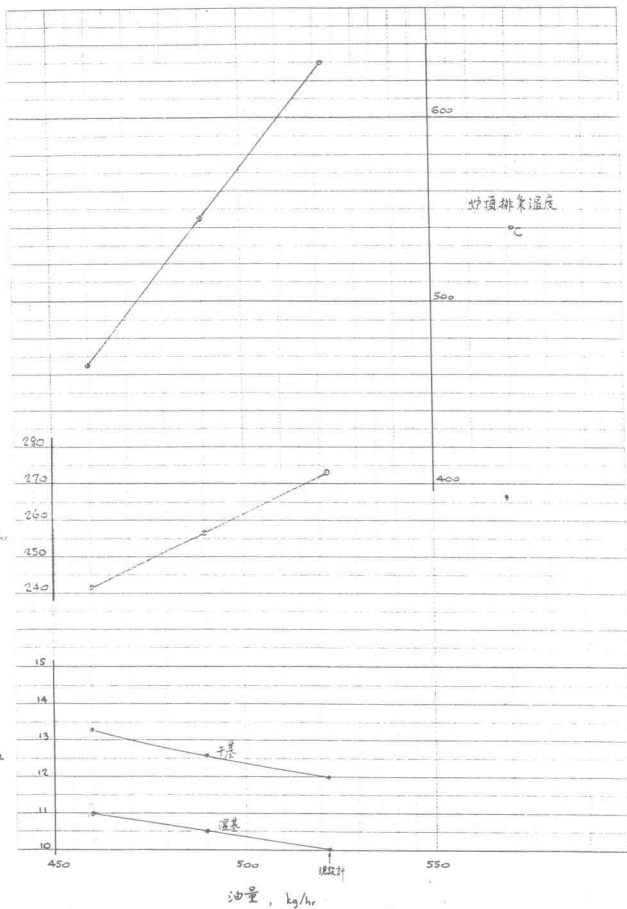
应城 15,000 T/Y 石膏炉

76-7-18



76-7-18

应城 15,000 7/4 石膏炉：降油效应



1976年重工业技术项目 计算书

1976.5 ~ 1977.12

5 t 100% H_2SO_4

5 t: $CaSO_4 \cdot 2H_2O$	2 t	¥ 60	
焦炭	0.112 t	3.3	} 燃料 ¥ 33.3
油	0.05 t	20	
煤	0.2 t	10	
电	200 kWh	12	
水	90 m ³		
V cat.	0.1 kg	0.5	
工资与机械损耗		17	
		¥ 33	

收入: H_2SO_4	1 t	¥ 110
CaO	0.5 t	15
		¥ 125

经费-

燃料与燃料	¥ 600,000	钢 90 t	木 60 m ³	水泥 100 t
制酸	¥ 1,740,000	250	20	100
原料	500,000	75	180	260
公用工程 (水、电、运费)	440,000	35	140	205
Σ	¥ 3,280,000	450 t	400 m ³	665 t

菱铁矿的烧结 - 钢铁设计院; 营口钢铁厂

中国科学院化工冶金研究所

课题分解 -

1. 流程原理 (烧结矿的烧结原理和热力学原理; 窑内气氛控制)
2. 流程小试 (可在化试中进行; 对材料、设计、设备制造、调试和验收)
3. 中试, 2500K (2.5吨/小时化试矿; 可在化试中进行)
4. 111分矿反反应 (流动试验; 可在化试中进行; 需配备新设备, 包括与窑炉; 对材料、设计)
5. 菱铁矿分解的机理化学 (请钢铁设计院进行)

技术路线 -

1. 架桥式烧结管
2. 快速烧结化的基本原理
3. 多级旋风除尘器设计 (1982年设计; 可进一步完善设计)

