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SILICON REFINEMENT BY CHEMICAL VAPOR TRANSPORT

SOLAR ENERGY RESEARCH INSTITUTE

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TECHNOLOGY SILICON MATERIALS	REPORT DATE OCTOBER 1, 1984
APPROACH VAPOR TRANSPORT PURIFICATION OF Si USING A $Si:Cu_3Si$ SOURCE	STATUS -CASTING OF LARGE ALLOY PLATES HAS BEEN ACHIEVED -CHARACTERIZATION OF A LARGER RESEARCH SCALE REACTOR IS NEAR COMPLETION -REFINED SILICON PRODUCT HAS BEEN SHOWN TO YIELD SOLAR CELLS WITH NEAR STATE-OF- THE-ART CONVERSION EFFICIENCIES
CONTRACTOR SOLAR ENERGY RESEARCH INSTITUTE	
GOALS STUDY THE OPERATING CHARACTERISTICS OF THE PURIFICATION PROCESS INCLUDING FACTORS AFFECTING THE RATE, THE PURIFICATION EFFICIENCY, AND THE PHOTOVOLTAIC QUALITY OF THE REFINED SILICON	

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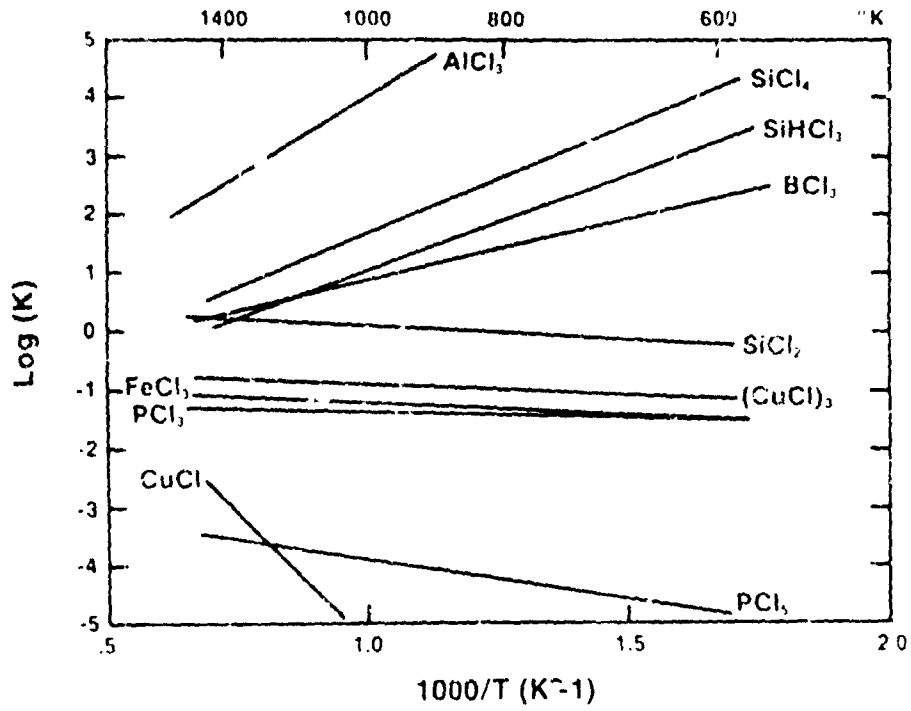
SILICON MATERIAL

Impurity	mgSi (ppma)	CVT Refined (ppma)
Cu	—	0.12 - 0.15
B	117	< 0.26
P	15	0.16 - 1.8
Al	> 3400	< 0.1 - 0.98
Fe	> 2500	< 0.13 - 0.50
Mn	550	< 3.15
Ca	290	< 0.07 - 0.2
Ti	290	< 0.06
V	250	< 0.055 - 0.44
Ni	39	< 0.13 - 1.9
Zr	13	0.09
Mo	1.4	< 0.09

†R. H. Hopkins, et. al. (n-type base)

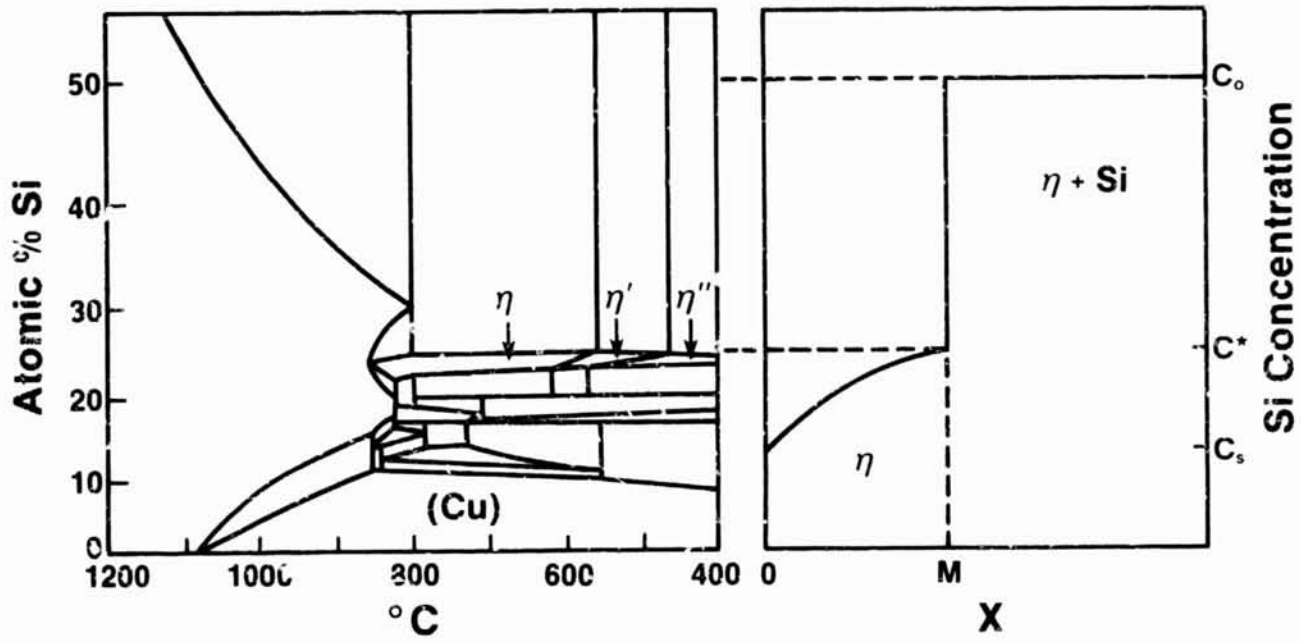
*p-type base

CVT Transport per Mole HCl

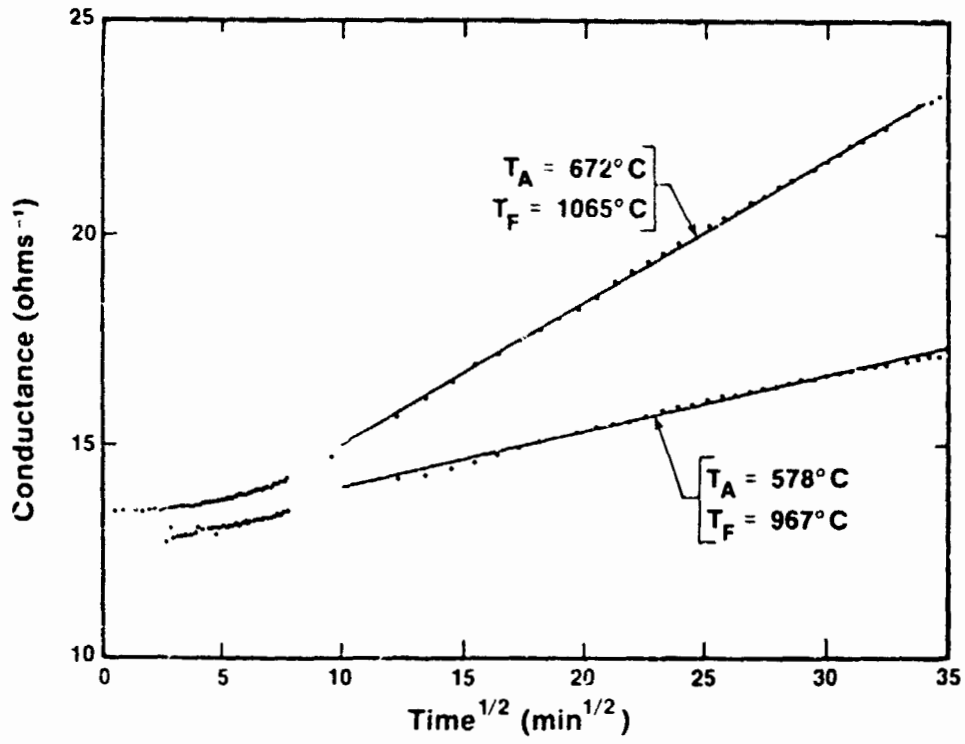


SILICON MATERIAL

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SILICON MATERIAL



SILICON MATERIAL

Electronic Properties

	<u>RECRYSTALLIZED</u>	<u>AS DEPOSITED</u>
RESISTIVITY	0.08.	0.1-1
HALL MOBILITY	524	
$n_i - n_A$	1.5×10^{17}	

PHOTOVOLTAIC CHARACTERISTICS
(NO AR COATING)

	<u>VTE REFINED SI</u>	<u>CONTROL CELLS</u>
V_{oc} (mV)	622	604
J_{sc} (mAcm ⁻²)	19.6	19.6
F	0.81	0.81
EFFICIENCY	9.8%	9.6%
BASE RESISTIVITY	0.08	0.2

Sample: Si $V_{oc} = 0.5945$ volts
Date: APR 30 1984 17:00 $J_{sc} = 19.71$ mA/cm²
Temperature = 28.0° C Fill factor = 79.94%
Area = 0.1000 cm² Efficiency = 9.37%

