

UNION CARBIDE CORP. POLYSILICON STATUS AND PLANS

JET PROPULSION LABORATORY

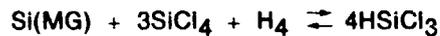
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UCC Silane-to-Silicon Process

SEQUENCE OF PROCESS STEPS

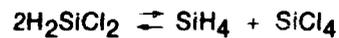
- SILANE SYNTHESIS

- HYDROCHLORINATION:



- REMOVE METAL IMPURITIES AS CHLORIDES

- REDISTRIBUTION $2\text{H SiCl}_3 \rightleftharpoons \text{SiH}_4 + \text{SiCl}_4$



- DISTILLATION/PURIFICATION OF SiH_4 AND CHLOROSILANES

- SILICON CONVERSION (SiH_4 TO Si)

- FLUIDIZED-BED Si DEPOSITION ON SEED PARTICLES (FREE-FLOWING Si PARTICLES $> 300\mu\text{M}$)

- FREE SPACE REACTOR PYROLYSIS AND THEN MELTING/SHOTTING ($> 2 \text{ MM SHOT}$)

- RECYCLING OF H_2 AND SiCl_4

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Contract Progress

- CONTRACT (#954334) STARTED OCTOBER, 1975
- PROCESS FEASIBILITY EXPERIMENTALLY DEMONSTRATED
- SILANE/SILICON PROCESS DESIGN COMPLETED
- COST ESTIMATES INDICATE CAPABILITY OF MEETING THE <\$14/KG (1980 \$) Si PRICE GOAL
- SILANE SYNTHESIS APPROACH WELL ESTABLISHED
 - NEEDS TO BE TESTED IN CONTINUOUS STEADY-STATE OPERATION OF EPSDU (EXPERIMENTAL PROCESS SYSTEM DEVELOPMENT UNIT)
 - ENGINEERING DESIGN COMPLETED
 - EQUIPMENT FOR EPSDU FABRICATED
 - CIVIL CONTRACT AT EAST CHICAGO UCC SITE COMPLETED
 - JPL/DOE FUNDING FOR SILANE SYNTHESIS EPSDU STOPPED BEFORE MECHANICAL AND ELECTRICAL INSTALLATIONS
- CONVERSION OF SILANE TO SILICON:
 - FLUIDIZED-BED APPROACH APPEARS PROMISING, BUT NEEDS FURTHER R & D. EFFORT WILL CONTINUE UNDER DOE/JPL CONTRACT
 - FREE-SPACE REACTOR APPROACH IS LESS FAVORABLE. MAJOR PROBLEMS IN POWDER HANDLING, MELTING, SHOTTING OPERATION AND PURITY CONTROL
- CONTRACT MODIFICATIONS ARE UNDERWAY. THESE ARE EXPECTED TO RESULT IN UCC OPERATING EPSDU AT THEIR EXPENSE WITH PERFORMANCE RESULTS AVAILABLE TO DOE/JPL

Status: UCC Plans for Polysilicon Production

- ON MAY 1, 1981, UCC ANNOUNCED ITS INTENTION TO BUILD A 1000 MT/YR COMMERCIAL POLY SI PLANT IN WASHINGTON STATE. DESIGN TO BE BASED ON THE DATA FROM THE SILANE EPSDU; KOMATSU (SIEMENS TYPE) DEPOSITION REACTORS
- EPSDU EQUIPMENT MOVED (FROM EAST CHICAGO) AND BEING INSTALLED IN WASHOUGAL, WASHINGTON. THIS IS A UCC PILOT PLANT PROJECT. OPERATION EXPECTED IN FALL 1982 (USING KOMATSU REACTORS)

Future Activities and Prospects

- ADVANCED SILANE SYNTHESIS TECHNOLOGY (FBR) TO BE TESTED IN PILOT PLANT AT UCC ELECTRONIC MATERIALS TEST CENTER AS FINAL PHASE OF JPL/DOE R & D INVESTIGATION
- THE DEVELOPMENT OF SILANE/SILICON PROCESS CONTINUES TOWARD PROVIDING A LOW-COST POLY SI TECHNOLOGY. ALTHOUGH MANY FUNDING/SCHEDULE CHANGES OCCURRED, THE SUCCESSFUL CONTINUATION OF THIS PROGRAM SHOWS THAT THIS APPROACH REPRESENTS AN EFFECTIVE WAY OF CONDUCTING COOPERATIVE ENERGY R & D BY THE INDUSTRY AND THE GOVERNMENT
- FSA/DOE GOAL OF < \$14/KG SILICON CAN ONLY BE ACHIEVED BY SILANE/SILICON PROCESS WHICH INCORPORATES NEW TECHNOLOGY DEPOSITION REACTOR - SUCH AS FBR BEING INVESTIGATED