N86-29352

SUMMARY OF PROCESS RESEARCH ANALYSIS EFFORTS

JET PROPULSION LABORATORY

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Introduction

- **Process design/cell design**
- **Cell efficiency drivers:**
  - **Bulk parameters and cell parameters**
  - **Tailored process sequences**
  - **New process options**
  - **Process control**
- **Lifetime improvement drivers:**
  - **Diffusion barriers**
  - **Encapsulation**

Process Design and Cell Design

- **Interactive effort**
- **Physics determines efficiency and sensitivity**
- **Research interest areas**
  - **Previous PV research (MIS)**
  - **IC processes (poly Si, light pulse)**
  - **Miscellaneous industries**
    - **Thick Film (MOD)**
    - **Ink-jet printing (MOD)**
    - **Magnetic memory (high-rate metallization)**

Cell Efficiency Drivers

- **Bulk parameters and cell parameters**
  - **Available bulk parameters**
    - **Cost and availability**
    - **Size**
  - **Retention and enhancement of parameters**
    - **Thermal history: precipitates, dislocation clusters, gettering**
    - **Contamination: environmental, handling, materials**
  - **Cell design**
    - **Design goal, not specification: -e.g., poly vs thin oxide**
  - **Cost vs performance**
    - **Life-cycle cost**
    - **Learning curve**
    - **Metallization system**

Tailored Process Sequences

- **Bulk material dependency**
  - **Cz**
  - **FZ**
  - **Web**
- **Shape-dependent**
- **Equipment-dependent**

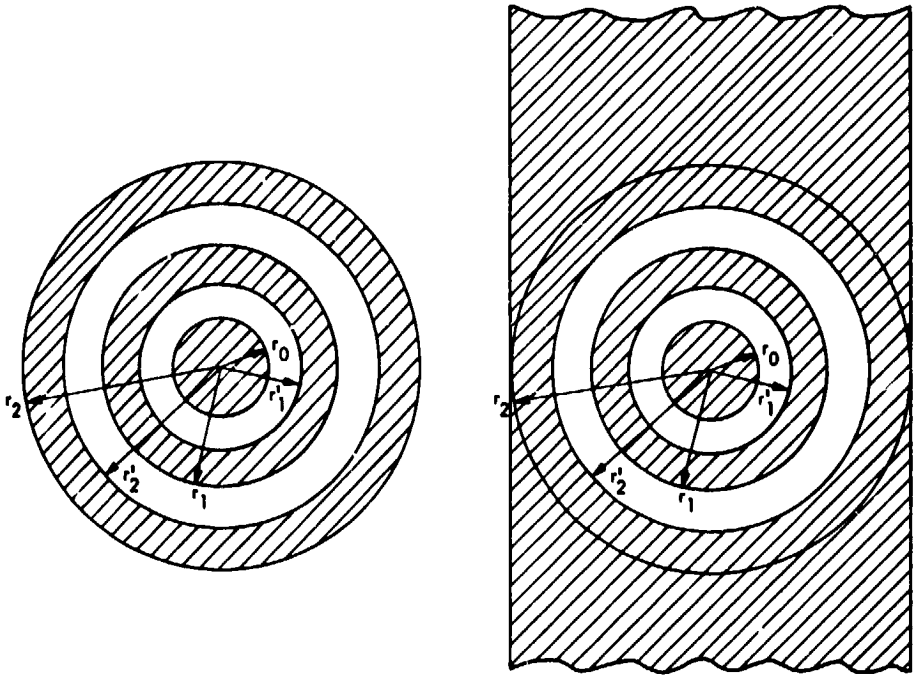
New Process Options

- **Lasers**
- **Robotics**
- **Thermal pulse**
- **New materials**
  - **Polysilicon**
  - **MOD**

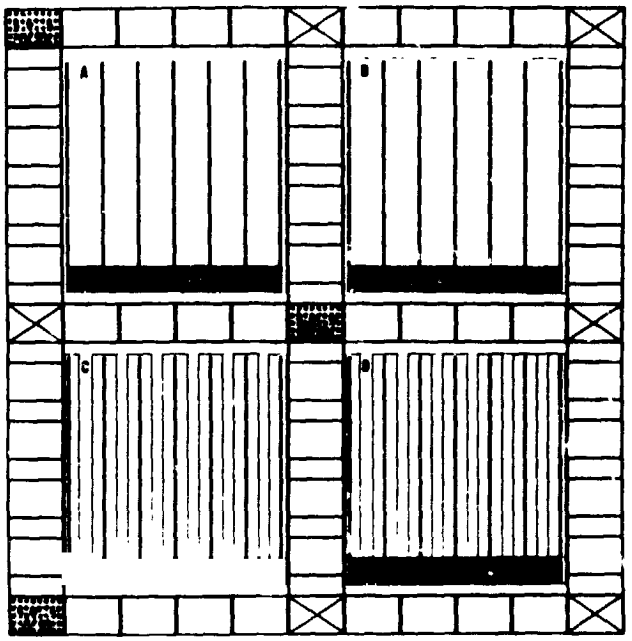
Process Control

- **Yield Management = profits**
- **Low-cost data acquisition and analysis**
- **IEEE-488 compatibility**
- **Test patterns**
  - **Circular TLM**
  - **NBS-22 pattern (NBS 81-2260)**
- **Non-contacting testing**
  - **Therma probe**
  - **X-ray photoemission spectrometry**
  - **FTIR**
- **Contact testing**
  - **I/f noise**

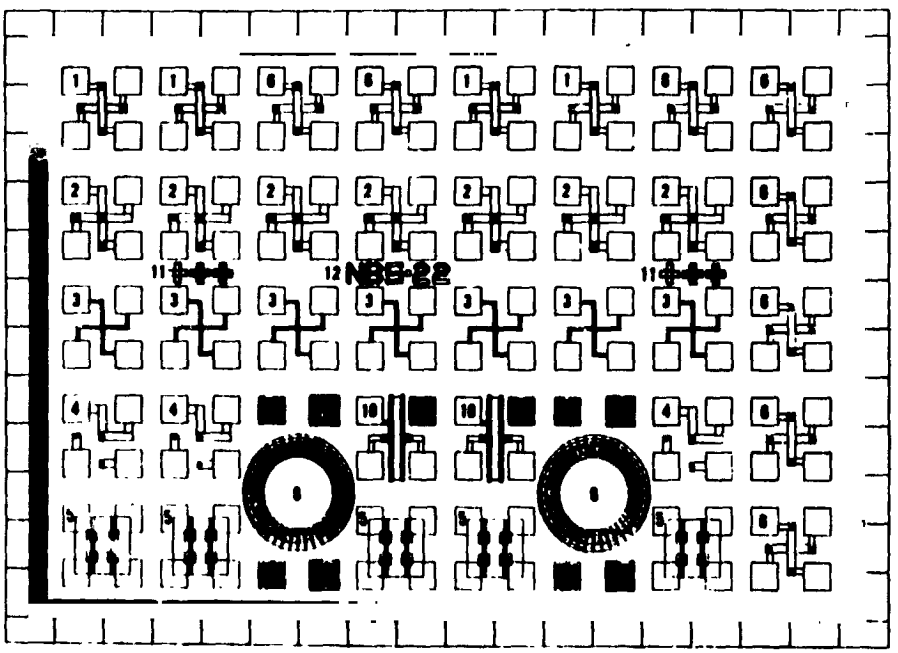
CTLM Test Patterns



NBS-22 Solar-Cell Test Pattern



Reference Test Structures



Lifetime Improvement Drivers

- **Diffusion barriers**
  - **Reduce rate of ambient thermal diffusion**
  - **Reduce rate of chemical activity**
- **Encapsulation**
  - **Provide environmental barrier**
  - **Provide circuit insulation**
  - **Low degradation rate**
  - **Should not enhance chemical activity**