SHORT-CIRCUIT CURRENT IMPROVEMENT IN THIN CELLS WITH A GRIDDED BACK CONTACT*

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The use of a gridded back contact was undertaken recently on thin silicon solar cells (50 μm) with the objective of decreasing the weight of the cells still further for space application. An unexpected increase in short-circuit current of almost 10 percent was experienced for 2 cm x 2 cm cells. Figure 1 is a photograph which shows the contact grid pattern on both the front and back of the cell as viewed in a mirror. Control cells with the standard continuous contact metallization were fabricated at the same time as the gridded back cells with all processes identical up to the formation of the back contact. The gridded back contact pattern was delineated by evaporation of Ti-Pd over a photoresist mask applied to the back of the wafer; the Ti-Pd film on the controls was applied in the standard fashion in a continuous layer over the back of the cell. Ti-Pd contacts were similarly applied to the front of the wafer, and the grid pattern on both sides of the cell was electroplated with 8-10 μm of silver. A p^+p back surface field (BSF) had been previously formed by alloying a screen-printed film of aluminum and chemically cleaning off the excess aluminum and other film residues.

Figure 2 compares the I-V plots for the 2 x 2 cells, showing the increase in short-circuit current which resulted for the gridded back contact cells in this experiment. The reasons for the increase in I_{sc} are presently under investigation. Among the possible mechanisms are:

- Optical reflection off the silicon/air interface of the gridded back which increases the light path through the silicon for thin cells.
- Improved bulk minority carrier lifetime because the gridded back results in stress release on the solar cell as compared to a continuous back metal contact.
- Improved back surface recombination velocity with the removal of the metal/silicon interface.

In an attempt to evaluate some of these possibilities, we compared IV characteristics for the gridded back thin cells with illumination from the front and back. These are illustrated in Figure 3 on cells which had no AR coat. There is an appreciable response with back illumination which suggests that back surface and bulk recombination are not excessive in this cell. The investigation is continuing and the results will be reported in a later publication.

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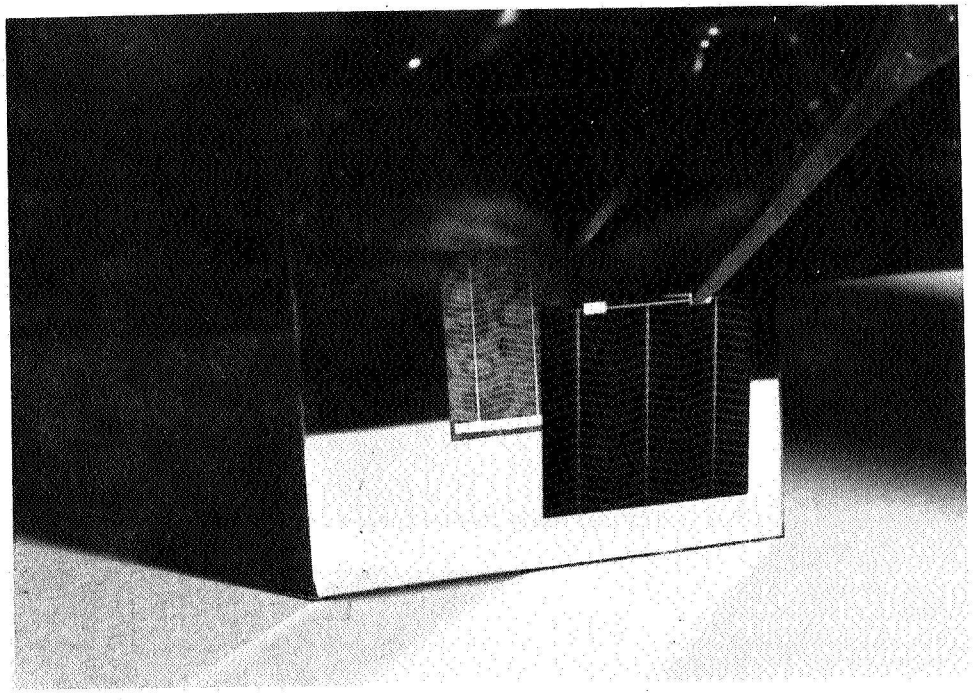

Figure 1. Contact Grid Pattern on Front and Back of Thin Cell.

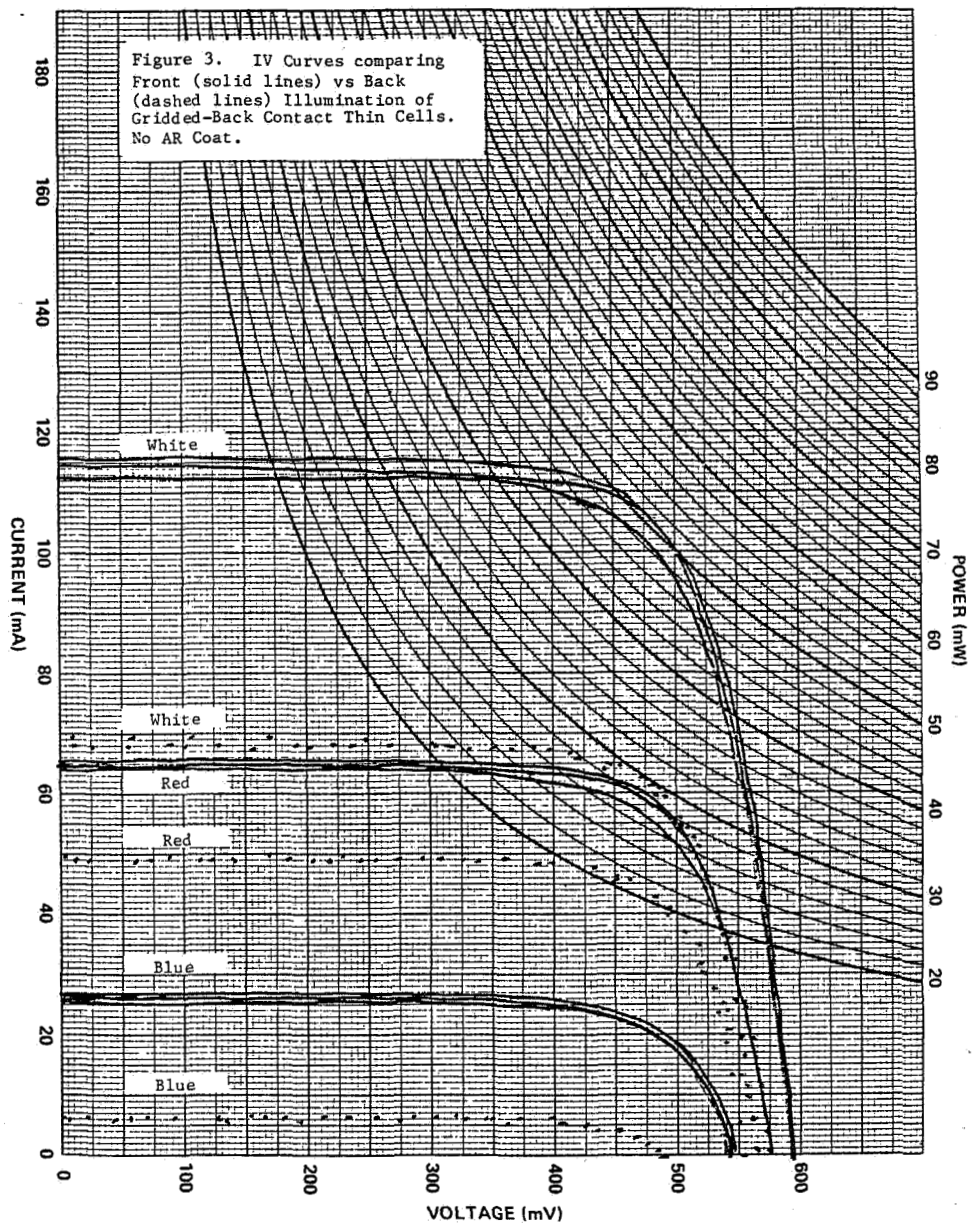

Figure 3. IV Curves comparing Front (solid lines) vs Back (dashed lines) Illumination of Gridded-Back Contact Thin Cells. No AR Coat.

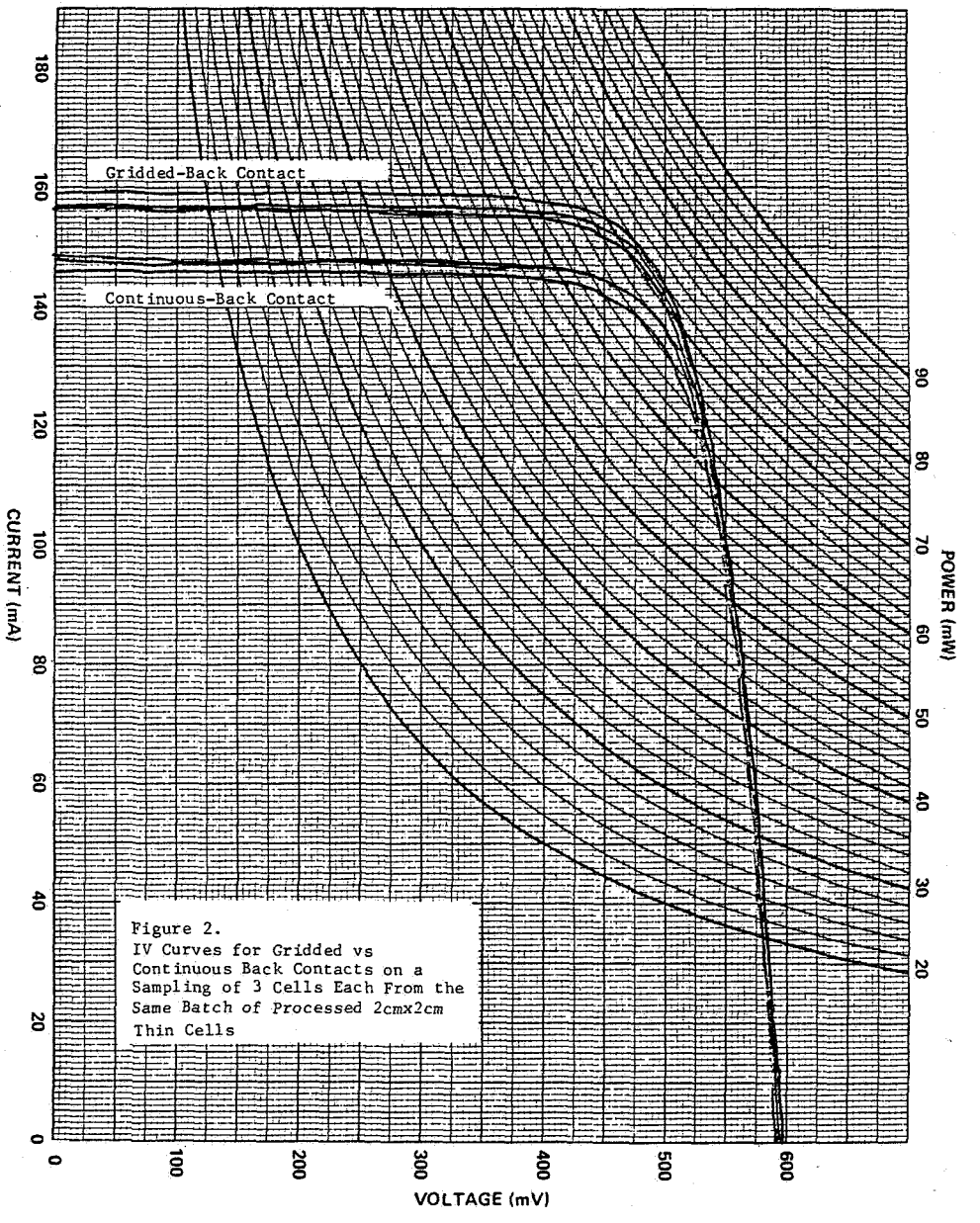

Figure 2.
IV Curves for Gridded vs Continuous Back Contacts on a Sampling of 3 Cells Each From the Same Batch of Processed 2cmx2cm Thin Cells