Megafake Institute of Technology

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((3) date)
January ??, 2009

((4) the following is the cover letter body)
Dear {e.g. *Super Energy* }editors,

Here states briefly why we think the paper entitled "*??????s*" belongs in {e.g. *Super Energy*. }

- **Significant results and broad scientific readership:**

(Here is one example) Photovoltaics (PV) promises to be a major renewable energy technology in the future because of the threat of global warming and the limited source of fossil fuel. Silicon thin-film solar cells can potentially get around the cost barrier of solar energy through much less amount of material use than conventional bulk modules. In addition, unlike other thin-film technologies (CdTe, Cu(In, Ga)Se_2, and GaAs), they do not suffer from limited supply of basic materials or toxicity of the components. Compared to hydrogenated amorphous silicon (a-Si) and nano-crystalline silicon films, ***polycrystalline silicon (poly-Si) thin films have better transport properties, and are not subject to light-induced degradation effects***. However, it is ***extremely challenging*** to grow high-quality poly-Si on inexpensive foreign substrates. One important issue is that inexpensive foreign substrates generally cannot be processed under high temperatures (> 600^{o}C) for a long time. To explore the crystallization behavior of a-Si thin films (deposited at low temperature ~200 ^{o}C) above these temperatures, it is necessary to expose the substrates to these elevated temperatures for very short periods of time. In this work, we are the first to apply millimeter-wave pulse annealing to *melt* crystallize a-Si films on glass, because of its unique ***selective heating*** of the films rather than the substrate at very short heating times.

We obtained unique, three-dimensional structures—silicon pillars—that were formed by ***millisecond*** pulses of 110-GHz millimeter-wave radiation incident upon intrinsic a-Si thin films deposited on glass by hot-wire chemical vapor deposition. These unique structures have not been observed before. We systematically studied these pillars. We found that these large pillars usually contain 1–2 randomly oriented grains with growth direction and grain boundaries perpendicular to the substrate surface. The grains in the Si pillars have ***ultra-high crystalline quality*** with grain sizes up to ***20*** μm (the grain size is usually ~1 μm with traditional approaches). We hypothesized the formation mechanism of the pillars based our observations. We note that no additional processing steps such as photolithography and etching were needed to form these unique silicon pillars. Such high-quality pillars have not been realized with other heating methods, including low-frequency microwave annealing, for Si on inexpensive foreign substrates.

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The ***advantages*** about this kind of annealing can be summarized as follows: (1) we can use low-thermal tolerant glass as substrates because of the heating selectivity of the wave, (2) a-Si films can be melted and then crystallized into big silicon grains in extremely short time, (3) minimal impurities into the film from the ambient and substrates, and (4) Si grains are almost defect-free.

Such understandings may enable us to prepare ***ultra-high-quality, large-grained*** poly-Si on inexpensive foreign substrates at large scale and low cost. Solar cells based on this technology are expected to have high efficiencies, which will make solar electricity competitive to traditional fossil-based energy. We believe that such a capability will also have a significant impact on developing other Si-based devices such as high-mobility Si transistors. We then believe that this manuscript will attract broad readers and trigger more interest in this area of many researchers from different disciplines such as renewable energy, environment, materials science, and solid-state devices.

- **Six suggested potential referees:**

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Thank you very much for your consideration.

Sincerely,

((5) scan your signature and copy-paste it here)

???, Ph.D.