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Solar Glitter – Microsystems Enabled Photovoltaics

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Many products have significantly benefitted from, or been enabled by, the ability to manufacture structures at an ever decreasing length scale. Obvious examples of this include integrated circuits, flat panel displays, micro-scale sensors, and LED lighting. These industries have benefited from length scale effects in terms of improved performance, reduced cost, or new functionality (or a combination of these). In a similar manner, we are working to take advantage of length scale effects that exist within solar photovoltaic (PV) systems. While this is a significant step away from traditional approaches to solar power systems, the benefits in terms of new functionality, improved performance, and reduced cost for solar power are compelling. We are exploring scale effects that result from the size of the solar cells within the system. We have developed unique cells of both crystalline silicon and III-V materials that are very thin (5-20 microns thick) and have very small lateral dimensions (on the order of hundreds of microns across). These cells minimize the amount of expensive semiconductor material required for the system, allow improved cell performance, and provide an expanded design space for both module and system concepts allowing optimized power output and reduced module and balance of system costs. Furthermore, the small size of the cells allows for unique high-efficiency, high-flexibility PV panels and new building-integrated PV options that are currently unavailable. These benefits provide a pathway for PV power to become cost competitive with grid power and allow unique power solutions independent of grid power.