

MAR11-2010-008762

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Challenges to Scaling CIGS Photovoltaics

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The challenges of scaling any photovoltaic technology to terawatts of global capacity are arguably more economic than technological or resource constraints. All commercial thin-film PV technologies are based on direct bandgap semiconductors whose absorption coefficient and bandgap alignment with the solar spectrum enable micron-thick coatings in lieu to hundreds of microns required using indirect-bandgap c-Si. Although thin-film PV reduces semiconductor materials cost, its manufacture is more capital intensive than c-Si production, and proportional to deposition rate. Only when combined with sufficient efficiency and cost of capital does this tradeoff yield lower manufacturing cost. CIGS has the potential to become the first thin film technology to achieve the terawatt benchmark because of its superior conversion efficiency, making it the only commercial thin film technology which demonstrably delivers performance comparable to the dominant incumbent, c-Si. Since module performance leverages total systems cost, this competitive advantage bears directly on CIGS' potential to displace c-Si and attract the requisite capital to finance the tens of gigawatts of annual production capacity needed to manufacture terawatts of PV modules apace with global demand growth.