

**University of Michigan Summer Undergraduate Research in Engineering (SURE)**

*Department of Materials Science and Engineering – Research Proposal*

Solar power presents enormous potential for abundant, clean energy. By using photovoltaics, this energy can be produced nearly anywhere light is present. Unfortunately, it is difficult to efficiently convert sunlight to electrical energy. Among other things, high efficiencies require extremely pure semiconductor materials. Such materials are expensive and subsequently increase the device's overall cost. Ultimately, this trade-off limits the widespread availability of solar power.

At the Laboratory for Innovative Green Energy Research, our goal is to fabricate low-cost clean-energy devices. One strategy aims to produce a useful solar cell from metallurgical grade silicon. Metallurgical grade silicon can be made at a low cost, but the material is traditionally not used in solar cells because of high concentrations of impurities. We believe, however, that this material can indeed be used for a functional device by making use of nanostructuring. In essence, a novel geometry will be used to reduce the required distance for minority carriers to diffuse across the p-n junction. As a result, the device's efficiency will improve, resulting in a useful, low-cost solar cell.

An entirely different approach to the problem involves the use of heterojunctions to simulate the band-structure of a solar cell. In this case, impure magnesium silicide will be combined with metallurgical grade silicon in a binary eutectic system to form a nanostructured lamellar microstructure. Under desirable conditions, a type II semiconductor heterojunction will result. The created band structure will resemble that of a p-n junction, and thus, this process could ultimately be used to produce solar cells at a low cost.