Structuring Si Surface for Light Management in Crystalline Si Solar Cell

Dr. Raşit Turan
Professor in Physics
Director of the Center for Solar Energy Research and Applications (GÜNAM), Middle East Technical University (METU), Ankara –Turkey

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With its indirect band structure and good reflecting properties, Si is a poor absorber particularly in the infrared part of the light spectrum. Thanks to surface texturing technologies, absorption and photocurrent generation can be significantly improved by a management of light using surface structures at micro and nanometer scale. Surface texturing can be done by wet and dry chemical etching or laser ablation. Metal Assisted Etching (MAE) is an electrochemical etching technique in which metal nanoparticles are used as catalyst in controlling the shape of the surface structures. It has been applied to solar cells with industrial size and evaluated for its applicability and performance in the energy conversion process. It is understood that optical gain due to the enhanced absorption is compensated by the electronic losses due to the high recombination at the textured surface with large area. Gain/loss ratio can be improved to some extend by controlling the surface shapes with solution chemistry. Use of laser is an alternative and dry approach for structuring the surface of Si. Black Si with almost no reflection can be fabricated using laser ablation operating at 1064 nm.