Texturing or anti-reflective films are applied to the surface of polycrystalline Si solar cells to enhance their efficiency. Hydrogen plasma treatment to bind the hydrogen to Si dangling bonds near the Si surface is also known to improve the properties at the crystal grains and grain boundaries. FTIR was used to evaluate the passivation effect under various application conditions by measuring the Si-H bond strength using a Fourier Transform Infrared Spectrophotometer (FTIR).

An Si-H peak near 2180 cm\(^{-1}\) and an N-H peak near 3300 cm\(^{-1}\) were confirmed. These peak intensities can be used for quantitative calculations of the hydrogen concentration.

Substitutional carbon atoms in crystalline Si appear as a peak at 605 cm\(^{-1}\) in the IR absorption spectrum. Determining the carbon concentration requires a reference sample with a 0.04 ppm max. carbon concentration. As these measurements were performed using an air blank, effects of the Si lattice vibrations appear near 610 cm\(^{-1}\). However, the changes in 605 cm\(^{-1}\) peak intensity indicate that carbon segregation occurred in the polycrystalline Si wafer.

Analysis and Evaluation Instruments for Polycrystalline Si Solar Cells

**UV-VIS-NIR Spectrophotometer:** Transmittance and reflectance measurements on substrates and films  
**3D Measuring Laser Microscope:** Evaluation of surface texture and top electrode three-dimensional shape  
**Scanning Electron Microscope:** Dynamic observations of silver top electrode sintering process  
**Hardness Tester / Universal Testing Machine:** Hardness of silver top electrode and peeling of soldered tabs on solar cells