Reducing Time and Costs of FT-IR Studies of Hydrogen Species in Si Wafers and Solar Cell Structures

Aßmann, N.

The quantification of hydrogen content in silicon (Si) solar cells is crucial because of its connection to light and elevated temperature degradation (LeTID) and surface degradation. Fourier Transform-Infrared (FT-IR) spectroscopy offers a quantitative technique for measuring the content of multiple hydrogen species in Si wafers that went through various process steps. In this methodological study we investigated the influence on hydrogen species in Si wafers of having the silicon nitride (SiNx:H) layer present during the measurements. Additionally, the impact of an emitter present during the firing on hydrogen species in Si wafers was inspected. Both, boron (B)- and (Ga)-doped p-type wafers were examined for detecting H-B, H-Ga, Oi-H2, and H2. As major difference of the two dopants we found the initial hydrogen species present in Ga and B Si wafers. While we could measure H-B and H2 signals in B-doped, only H-Ga was found in Ga-doped wafers. Furthermore, our results suggest a negligible influence of the presence on the hydrogen species of both, SiNx:H during measurements, and the emitter during firing. Thus, the preparation steps for FT-IR may be considerably simplified. Additionally, we performed measurements at different temperatures to test detection of HB and H2 with concentrations in 1014 cm-3 range, which confirmed a benefit of cryogenic temperatures.