Microwave Detected Photoconductivity (MDP)

MDP is a contact less, non destructive measurement technology for the electrical characterization of a large variety of semiconductors. The mapping and visualisation of so far not detectable defects was achieved by improving the sensitivity of a microwave detection system by several orders of magnitude. Electrical properties such as lifetime, t, mobility, μ, and diffusion length, L, can be measured also at very low injection levels with a spatial resolution limited only by the diffusion length of the charge carriers. The doping level of the material plays no major role.

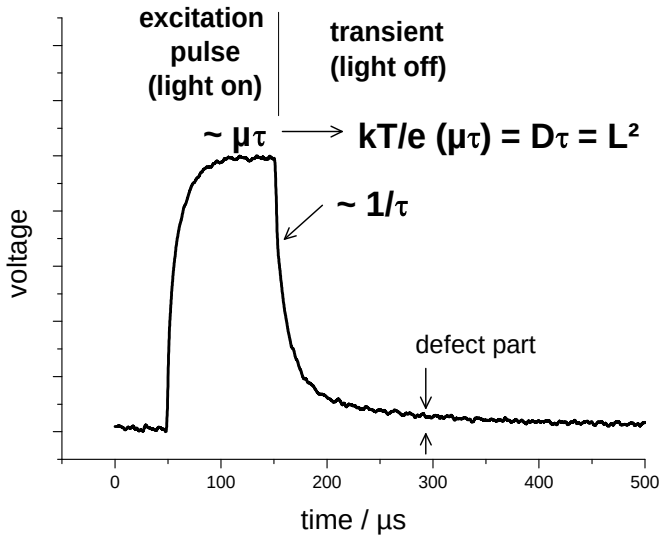

Fig. 1: Typical photoconductivity signal for a rectangular light pulse, p silicon wafer

Owing to the high sensitivity, at sufficiently low injection levels thermal excitation of charge carriers out of defect levels filled during a photo pulse can be observed even in high quality material, see Fig. 1. After the light is turned off, the photoconductivity transient signal consists mainly of two parts. The first part, a fast decay, corresponds to the minority carrier lifetime. This is followed by a much slower decay process due to the thermal emission of carriers out of defect levels. Important are sufficiently long photo pulses in order to fill the defect levels.

The MDP method can be applied to a wide range of materials such as ec and mc Silicon, Ge, SiGe, GaAs, InP, SiC, GaN, and even epitaxial layers. MDP is ideally suited for inline applications. With an advanced equipment, the measurement time for a complete one wafer topogram can be made as short as one second.