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Microphotoreflectance spectroscopy – a modulation technique with high spatial resolution

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Abstract

There is presented an experimental setup for the measurements of photomodulated reflectivity spectra of low-dimensional semiconductor structures with a micrometer spatial (plane) resolution. The setup has been developed as an extended and improved version of a standard bright configuration, *i.e.*, where the probe beam is provided directly by a broad band light source (*e.g.*, halogen lamp) and then it is dispersed after being reflected off the sample. It gives typically the plane resolution, expressed by the spot size of the beams on the sample surface, on the level of single millimetres. Introducing optics, based on a long working distance and a high numerical aperture microscope objective, has allowed decreasing the spot size by three orders of magnitude into the micrometer range for both the probe and the pump beams. The optimization of microphotoreflectance signal to noise ratio has made it possible to detect the normalized reflectivity coefficient changes ($\Delta R/R$) from an ultrathin single quantum well formed of the wetting layer in the structure with self-assembled InAs /GaAs quantum dots and from single pillar microresonators of the lateral sizes in the range of single micrometers.